POPULAR SCIENCE

MONTHLY

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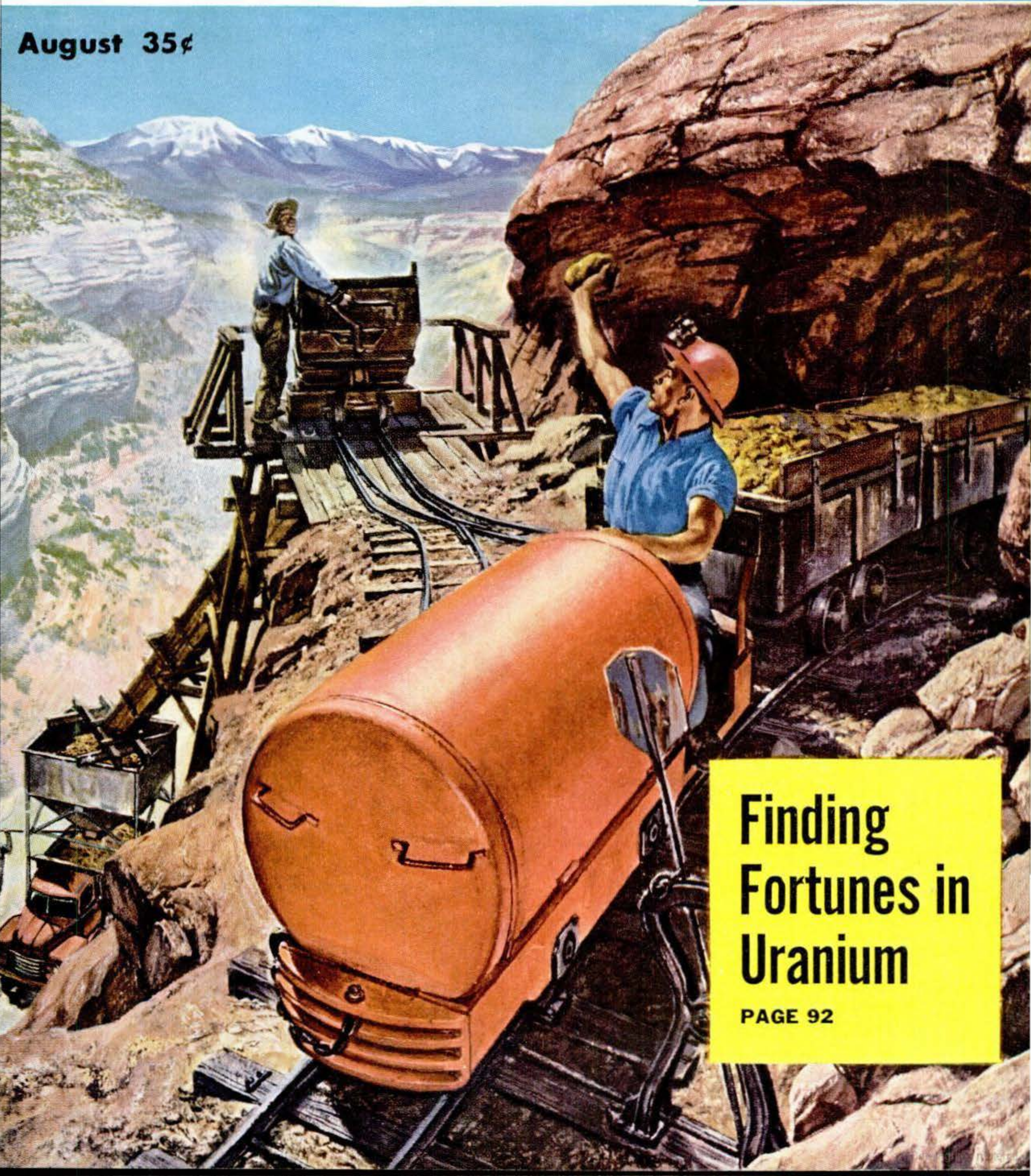
America's Newest Superhighway

Previewed on PAGE 65

Biggest Ship Ever Built

Exclusive Pictures on PAGE 128

August 35¢



Finding Fortunes in Uranium

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BLACK FOREST

KORIUM

Hunting Knife

Solingen Steel

The famed *BLACK FOREST HUNTING KNIFE* made in Solingen, West Germany of superfine *Nicht Rostend* (non-rusting) steel is *NOW* available in this country! The rugged beauty of this superb knife has already won recognition for design in industrial circles on the Continent—and its utility and value as an aid in hunting & fishing has made it a prime favorite with sportsmen all over Europe! Blade is actually sharp enough to shave with; it will stand up against the most rugged treatment; the genuine leather scabbard is metal tipped. Length, 10 inches. Tough, sturdy Solingen steel assures you years of dependable service. *The sleek, graceful lines of this new German import also provide an ideal recreation room or den decoration—a dandy gift for men—and a hunter's delight! It's a real collector's item, too; graces any wall or fireplace.* Import supply is limited and the low 3.95 price (postpaid) for *BOTH* knife and scabbard means you'll have to act fast! Send 3.95 for prompt delivery. CODs plus fees. Your money back quickly if you're not delighted! Use convenient coupon below.

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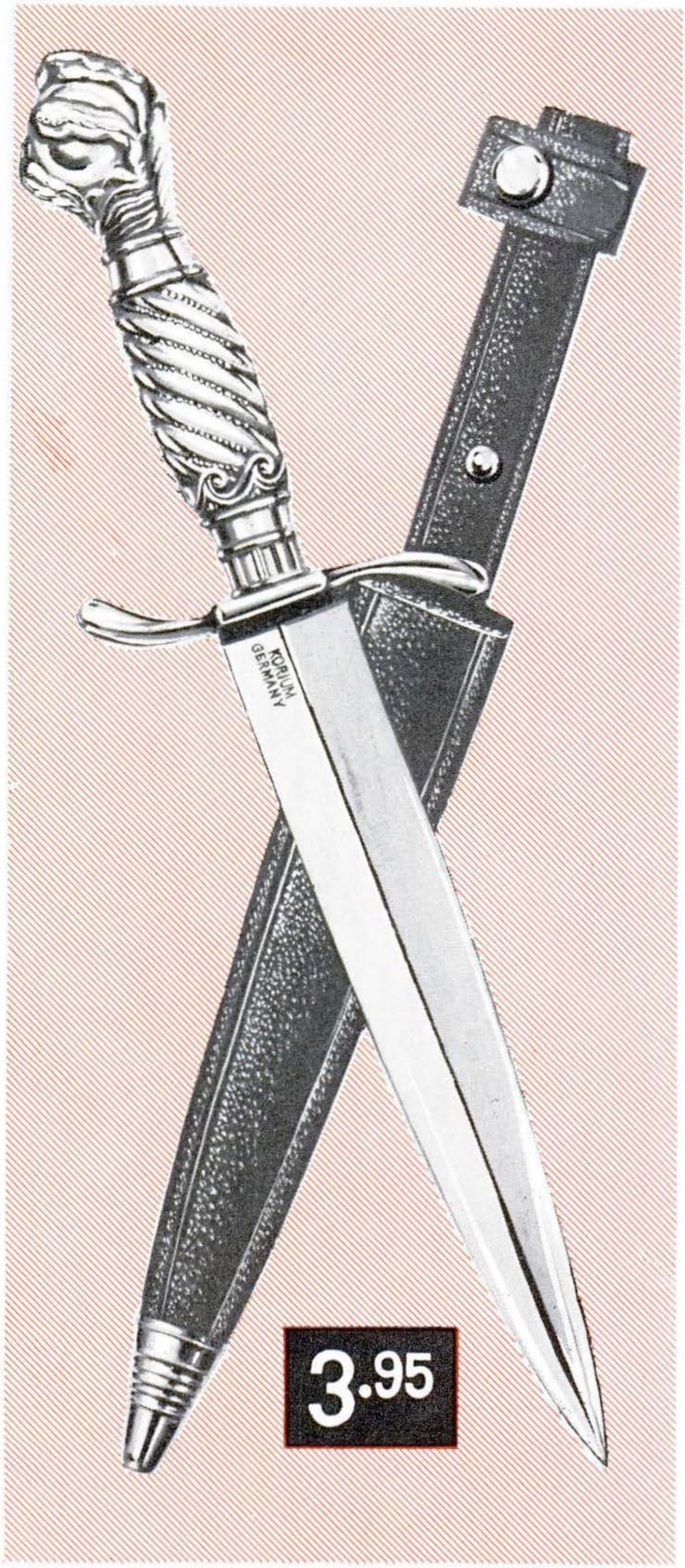

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America's Leading New-Idea Magazine for 82 Years

Founded 1872,
Vol. 165: No. 2

POPULAR SCIENCE

REG. U. S. PAT. OFF. *Monthly*

Mechanics and Handicraft
REG. U. S. PAT. OFF.

August, 1954

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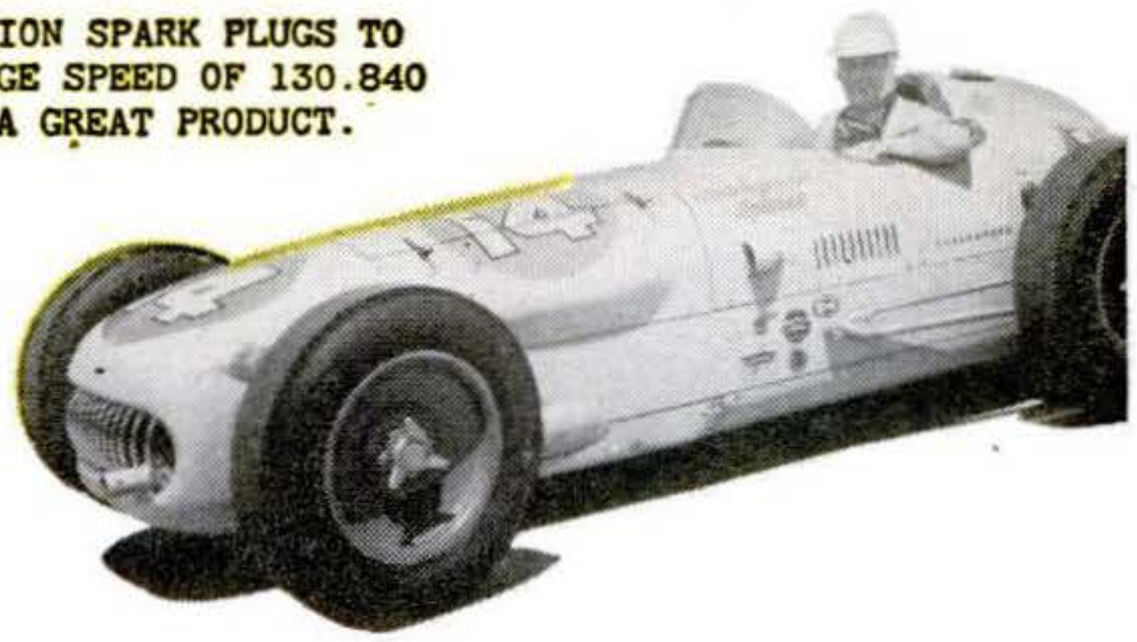

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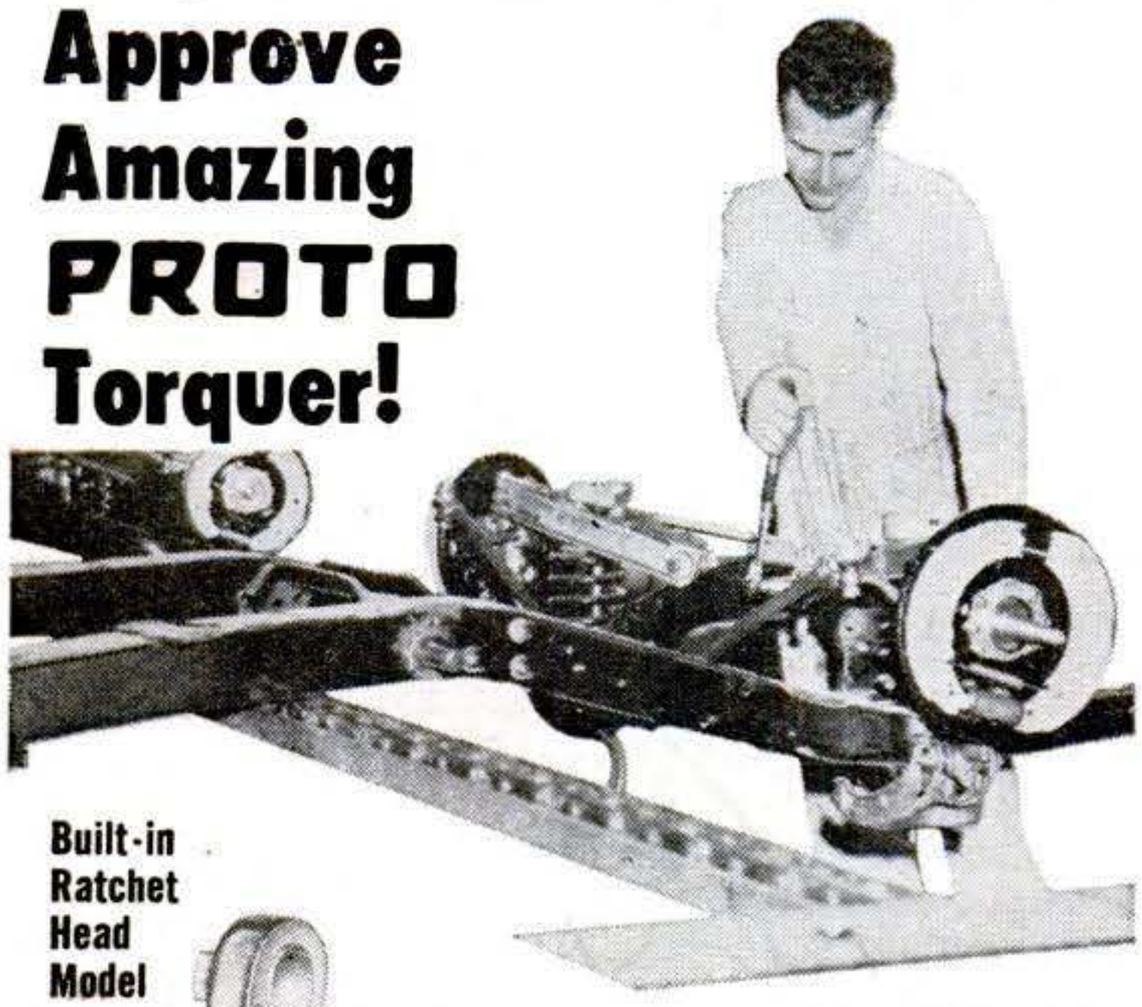

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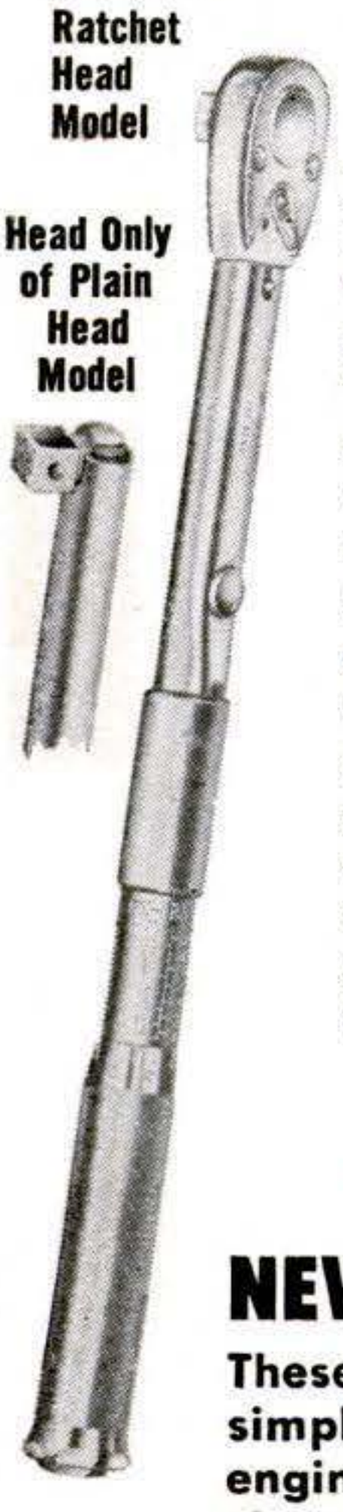
Head Only of Plain Head Model



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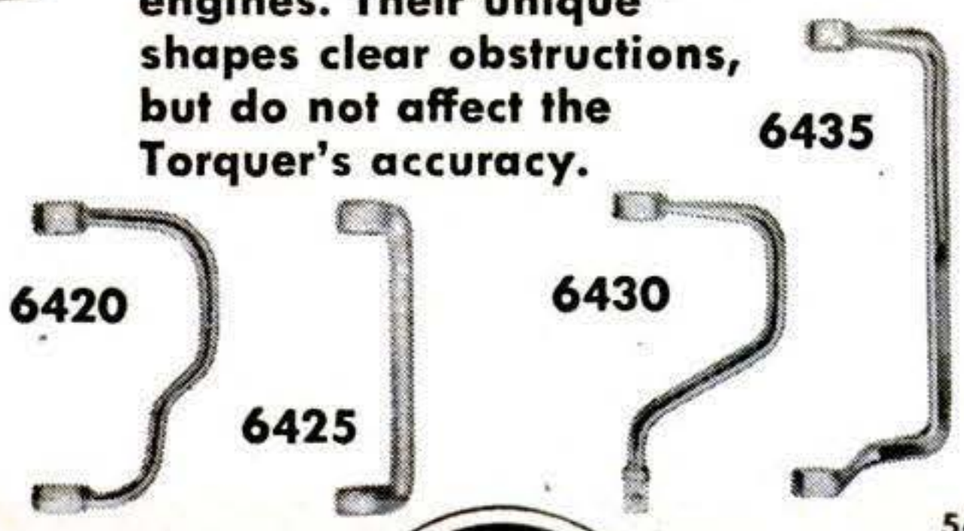

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His Pictures Almost Talk

IF ANYONE could make the Einstein Theory understandable in drawings it is Ray Pioch; we just haven't asked him to tackle that job yet. Pioch is a free-lance artist whose knack for making popular presentations of technical subjects has kept him busy turning out work for POPULAR SCIENCE MONTHLY for more than eight years.

Every month you can see examples of his skill in the "New Ideas from the Inventors" feature, where he translates complicated patent drawings into simple, understandable line sketches. To illustrate "Poor Man's Space Station," on page 72 of this issue, Pioch picked the brains of a physicist to show you what the MOUSE artificial moon would look like.

For relaxation, illustrator Pioch gets far away from his drawing board in his bright red, 235-horsepower convertible.

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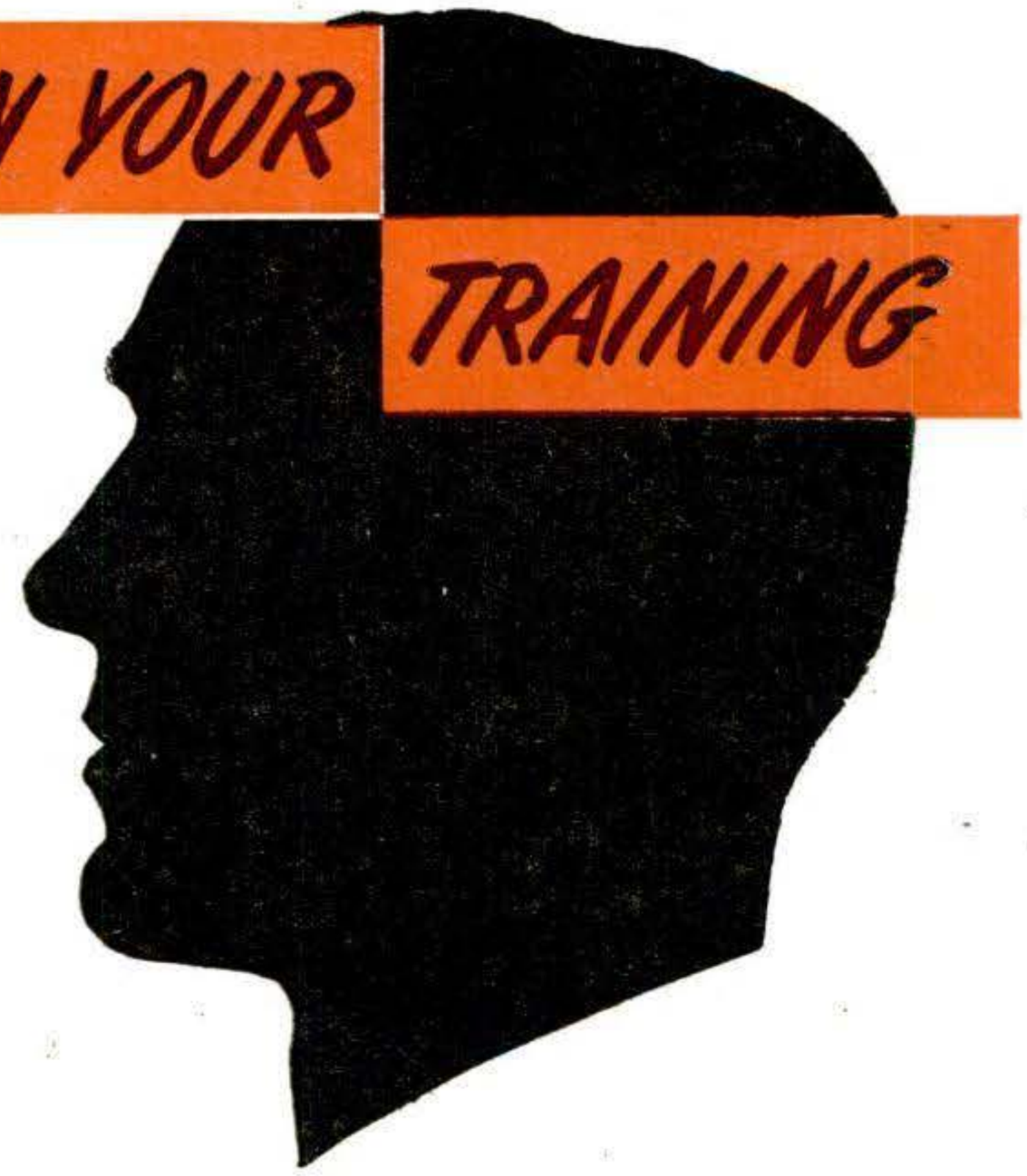

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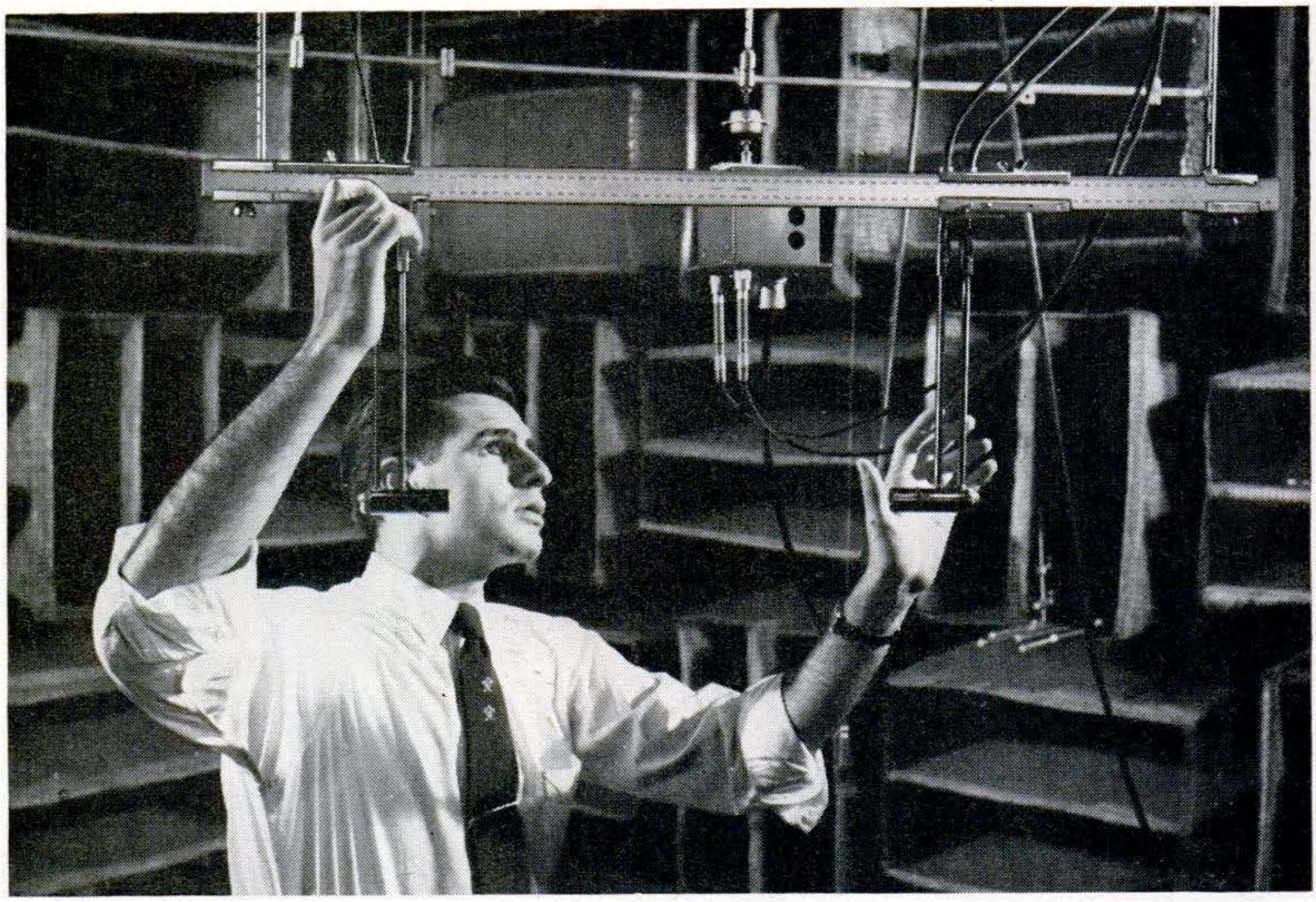

In a quiet room at Bell Laboratories an engineer scales off the distance between two condenser microphones during a calibrating test. Able to measure air pressure variations of a few billionths of an atmosphere, such microphones play a crucial role in the scientific study of telephone instruments.

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They are being calibrated by an engineer at Bell Telephone Laboratories to give extremely accurate information on the kind of sound your telephone company handles. Armed with these vital fundamental data on what sound *is*, Bell Laboratories scientists devise the instruments and equipment that transmit it best.

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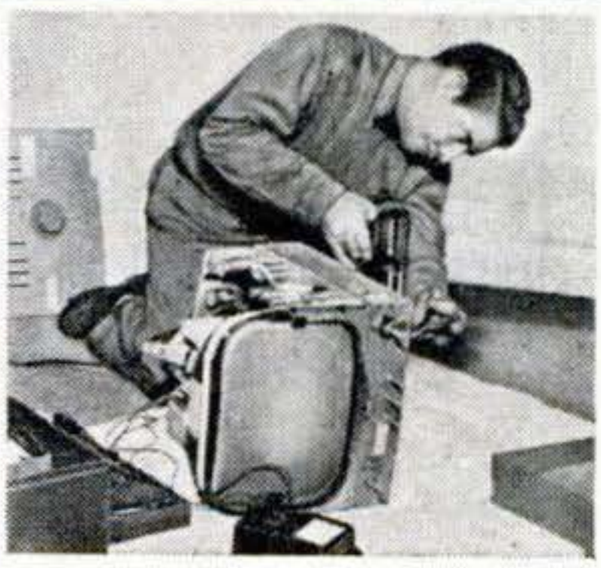

Prove It on Your Own Set

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Trouble-Shooting Chart Tells Where to Look for Bad Tube IF:

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No picture; raster OK; no sound.
No picture; no raster; sound OK.
No picture; raster OK; sound OK.
Picture wiggles and weaves, lacks blacks, or is very black; raster OK; sound OK.
Picture jittery, double image; raster OK; sound OK.
Snow on all channels; raster OK; sound weak.
Snow on all channels, raster OK; sound OK.
Picture and raster do not fill screen; sound OK.
Picture drifts up and down but not sideways; raster OK; sound OK.
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The author is Associate Editor of *Electronics* Magazine. He's a long-recognized expert—not only on radio and TV—but also on making technical subjects easily understood by the average reader. He has spent FOUR years making this one-volume instruction manual so practical and easy-to-understand that even a man who never fixed a door bell before will have no trouble.

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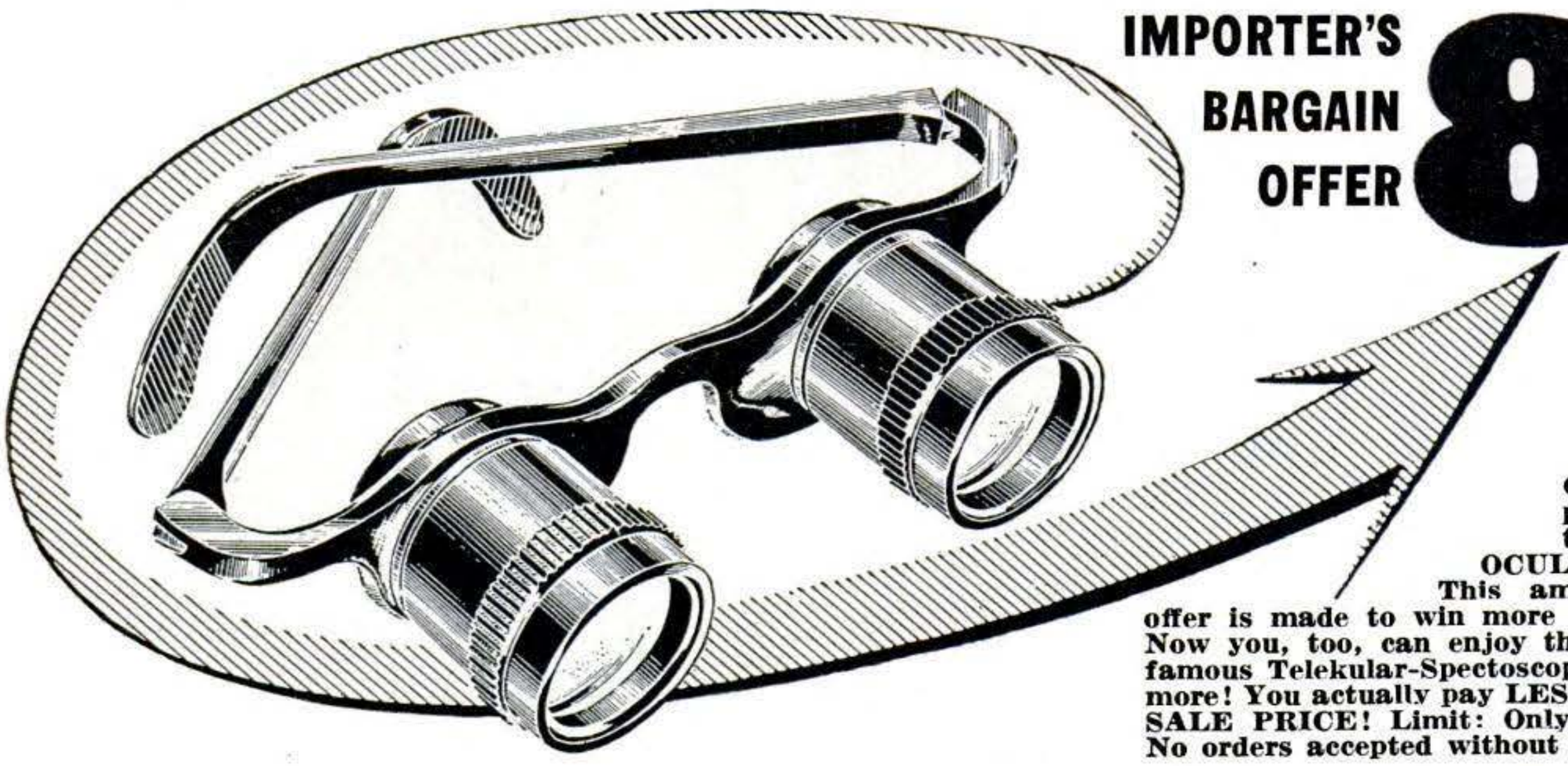

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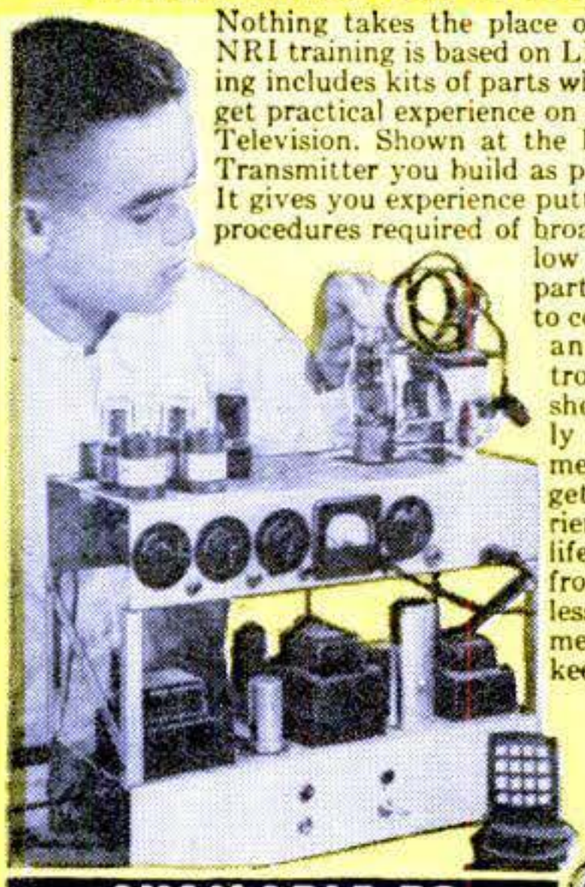
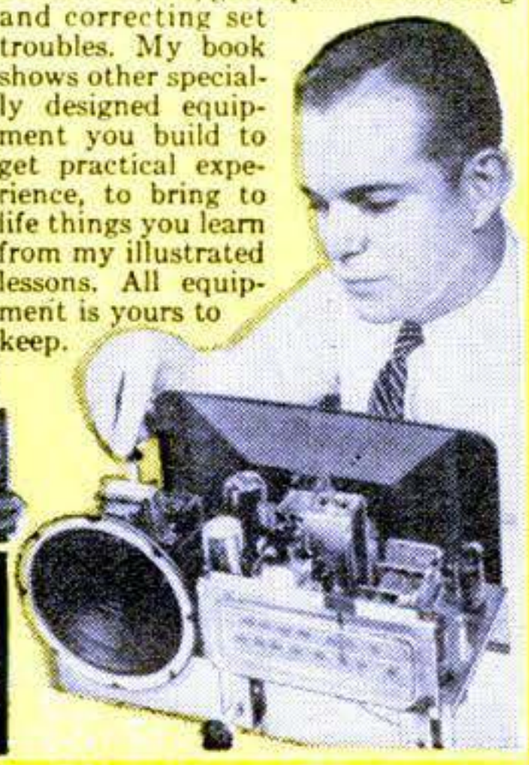


Nothing takes the place of practical experience. That's why NRI training is based on LEARNING BY DOING. My training includes kits of parts which you use to build equipment and get practical experience on circuits common to both Radio and Television. Shown at the left is the low-power Broadcasting Transmitter you build as part of my Communications Course. It gives you experience putting a station "on the air," learning procedures required of broadcast station operators. Shown below is the modern Radio you build as part of my Servicing Course. You use it to conduct tests, get experience locating and correcting set troubles. My book shows other specially designed equipment you build to get practical experience, to bring to life things you learn from my illustrated lessons. All equipment is yours to keep.



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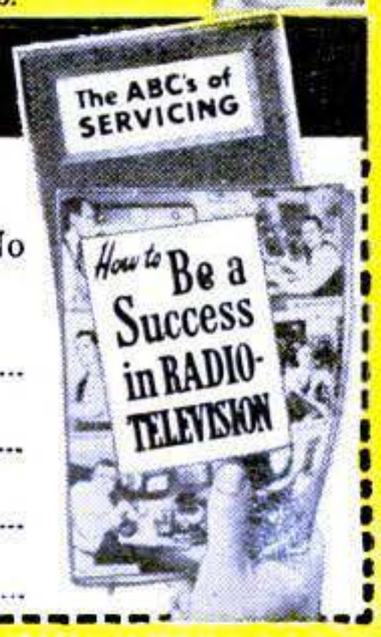

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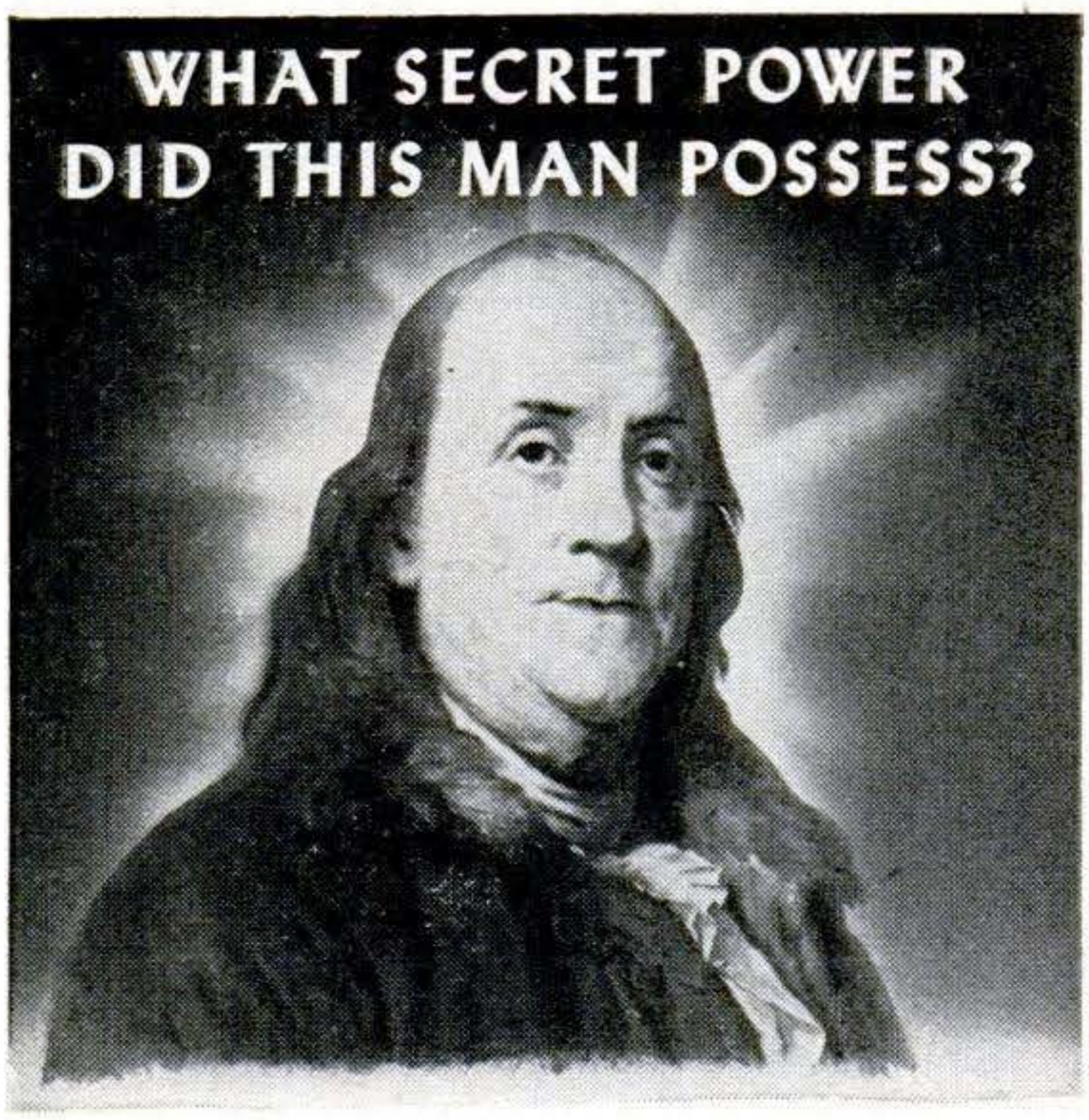

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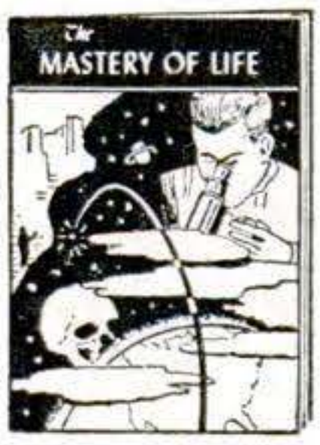

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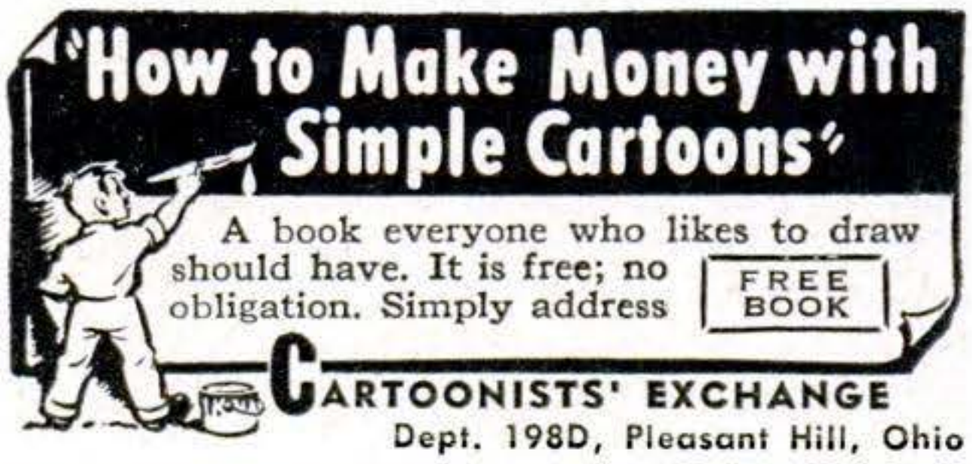

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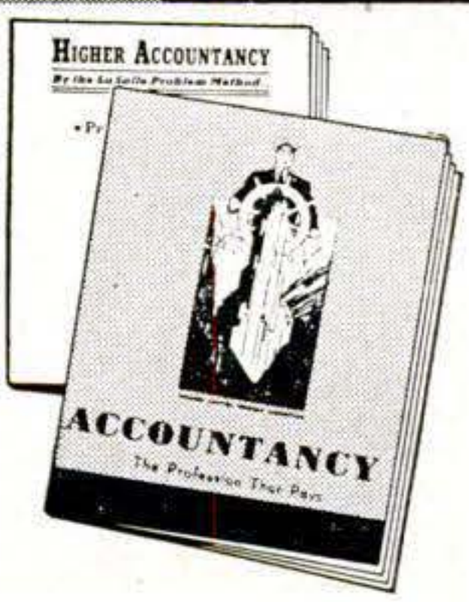

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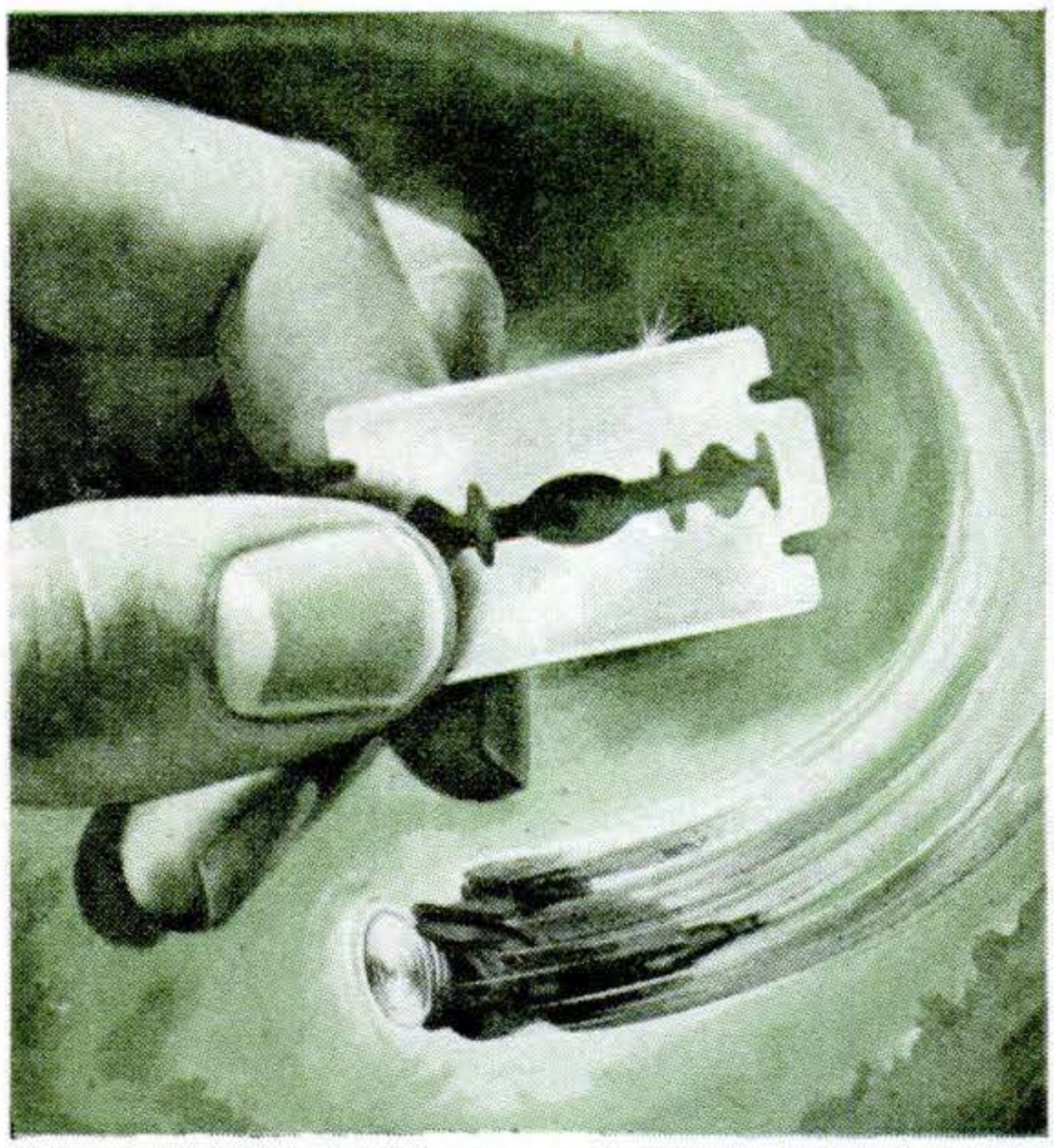

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Letters

Apologies to St. Paul

Your June issue [p. 76] stated that Minneapolis would be the only American city to see the sun totally blacked out in the eclipse of June 30.

I live within 10 miles of Minneapolis, in another American city, and—as I write this—hope to see the eclipse fine from my own back step.

W. R. Greer, St. Paul, Minn.

To Reader Greer, and the 311,348 other residents of St. Paul, our sincerest apologies for an unintended slight to one of America's great Twin Cities.

Boys Take to the Trees

This is to express our appreciation for the true-life story, "Our Boy Lives in a Tree," that you published in May [p. 93]. I have heard many compliments about it and it has inspired many younger boys in my neighbor-

hood to build a tree house. When they are in their tree house, they are out of trouble.

Robert L. Harris, sec., junior class, Wilmore High School, Wilmore, Ky.

Tribute from a Skin Diver

I am a very ardent skin diver—a wonderful sport which I took up after reading your article on how to build a diving lung last year. This year I decided to buy a commercial outfit and found it wonderful.

Now, after reading the special section in your June issue [p. 163], I am building

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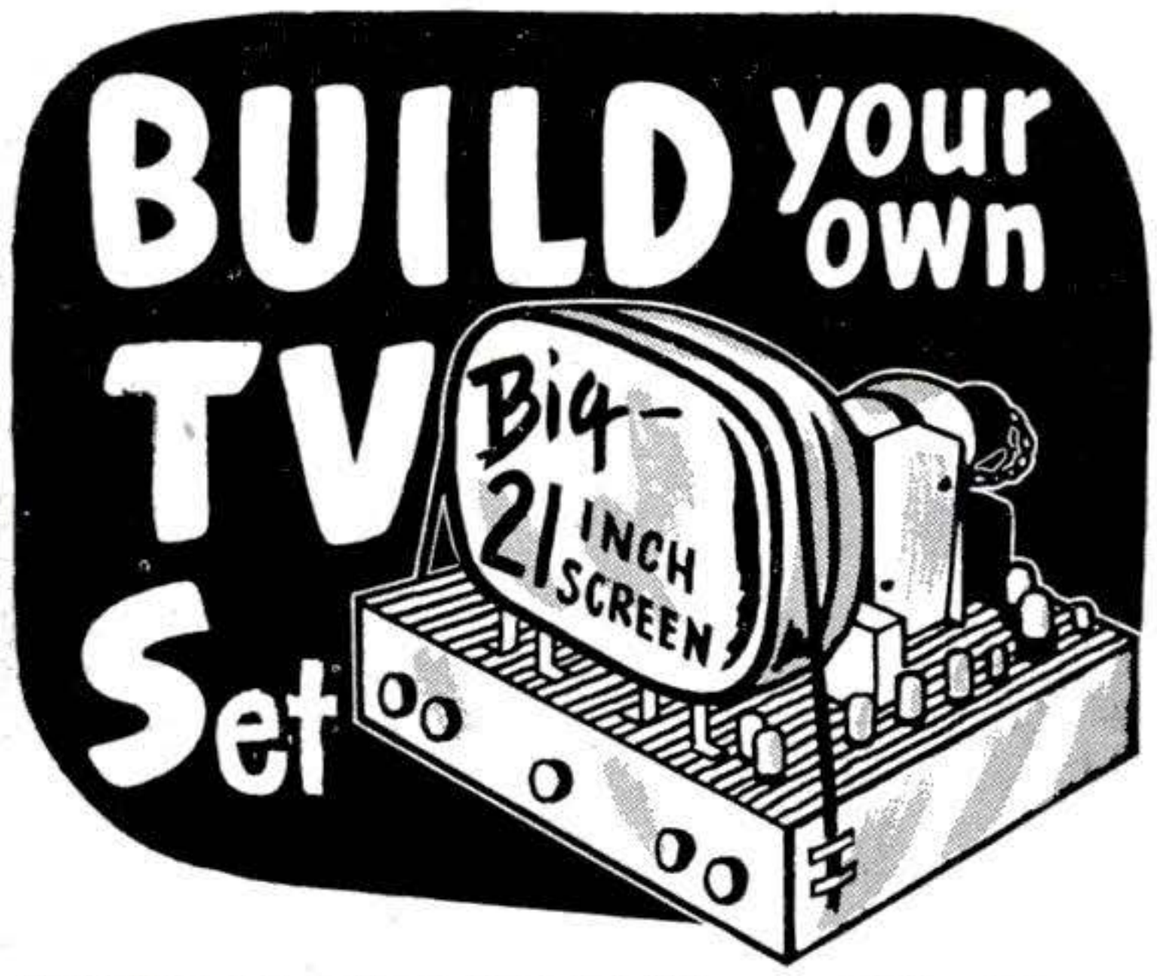

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an outfit with hose. I think that it will be more practical than my self-contained outfit for long, shallow dives.

PIERRE BOUCHER, Montreal

How to Quiet a Workbench

That guy who wrote you about putting rubber half soles on his platform rocker to keep it from "walking" [July, p. 8] had a good idea, but I think I've got an even better one. I put rubber heels on my work-

bench. They compensate for slight unevenness in the floor, protect the linoleum on it, absorb hammer-blow shocks, prevent wobble, keep the bench from skidding and —best of all—dampen out vibrations, so the floor doesn't behave like a sounding board.

ANDREW VENA, Philadelphia

We Get Around

It might interest you to know that nearly 800 students and the staff of our Institute read POPULAR SCIENCE every month. It is read over and over again until the pages fall apart!

R. A. CAPTAIN, Librarian,
S. J. Occupational Institute,
Bangalore, India

How to Rein a Rearing Tractor

After reading your article on "How Not to Drive a Tractor" [June, p. 133], I have a suggestion to make in the interest of saving lives. Why not insert a mercury contact switch, on or near the distributor, that would cut out the ignition when the front end rises to an angle of 45 degrees?

G. L. CHAMPAGNE, Convent, La.

We understand that this has been tried but isn't a dependable safeguard: a tractor that gets that far off balance is likely to turn on over.

A Buick's Life on the Range

About four years ago, I believe, you published a long article with pictures of a specially built Buick destined for the King

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If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

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Ranch in Texas [Jan. '50, p. 98]. That article has been a memorable one to me. I was very interested in the special features that were supposed to keep the car in its rugged condition. If it is possible, I would now like to see a picture of this vehicle after it has had four years of service.

DONALD V. DOYLE, Sioux City, Iowa

Here is a picture of El Kineno, as the specially built Buick was named, after four

years and 25,000 rugged miles on the range. Gillespie Buick in Corpus Christi, which services the car, reports that while the mileage hasn't been great, the car has had hard workouts in heavy sands, and scatting across open plains, chasing coyotes.

Engine, transmission, cooling system and special equipment, even including the air cushions, have been standing up very well.

Handy Lady

In spite of being a woman, I followed your April-issue directions [p. 241] and converted my lawn mower to power. No male help, but it works fine.

Now, something for you: To quiet a noisy, "dancing" electric fan, I put a lot of lead fishing sinkers in the hollow pedestal base and poured in melted paraffin. Then I jigsawed out a hardboard base with three rubber bumpers on it. The fan is quiet now.

GRACE HARTT ROSE, Tampa, Fla.

Nice going, Ma'am. A tip, though: It is technically "cleaner" to balance out vibration than to damp it out.

Monster vs. Brute

I have a few comments to make about Eddie Yung Jr.'s letter in your May issue (p. 16) concerning Bob Schmitt's twin-engine motorcycle. The Monster, as it is called, clocked 129.87 m.p.h. at the end of a quarter-mile, from a standing start. Mare-

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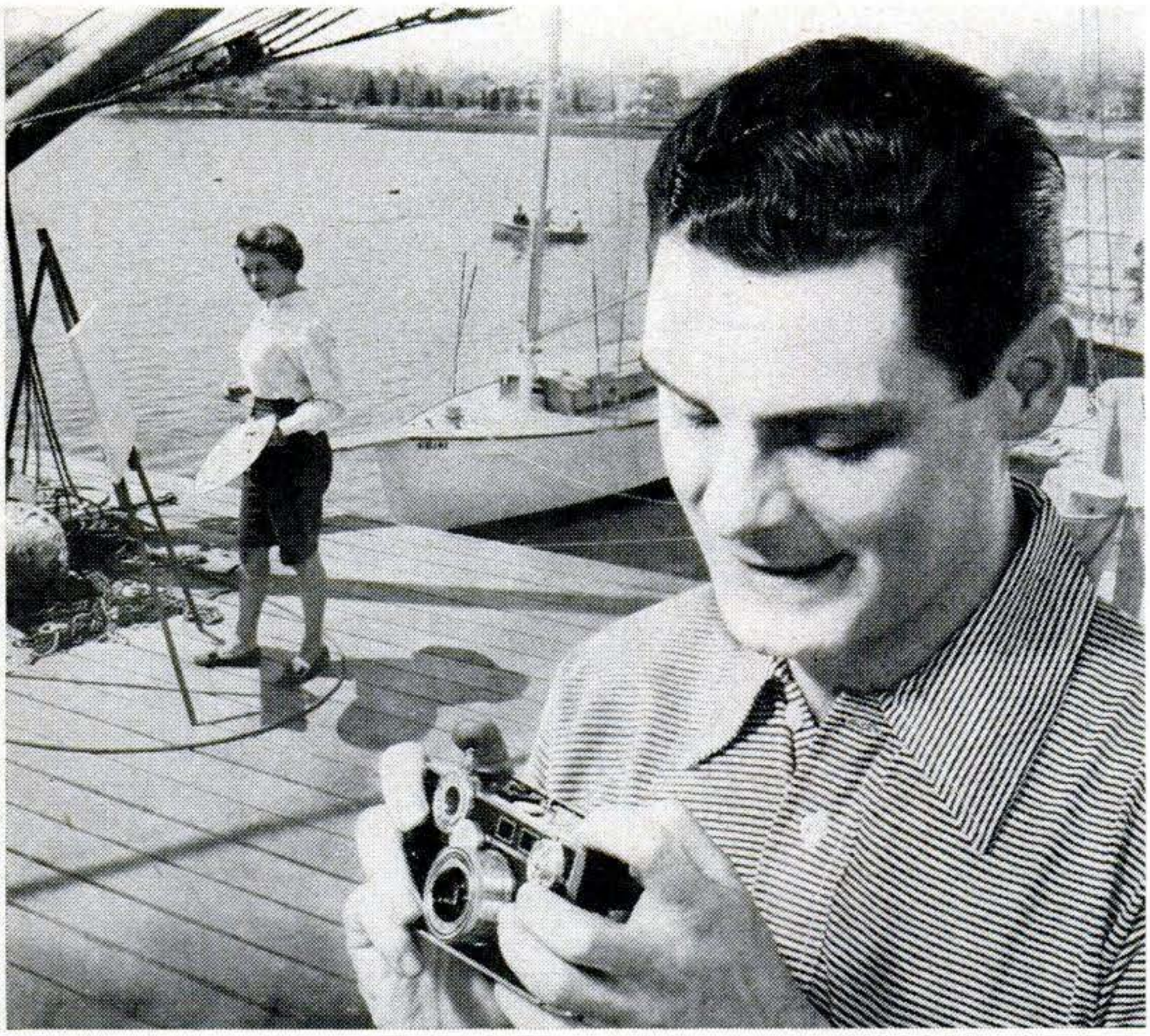

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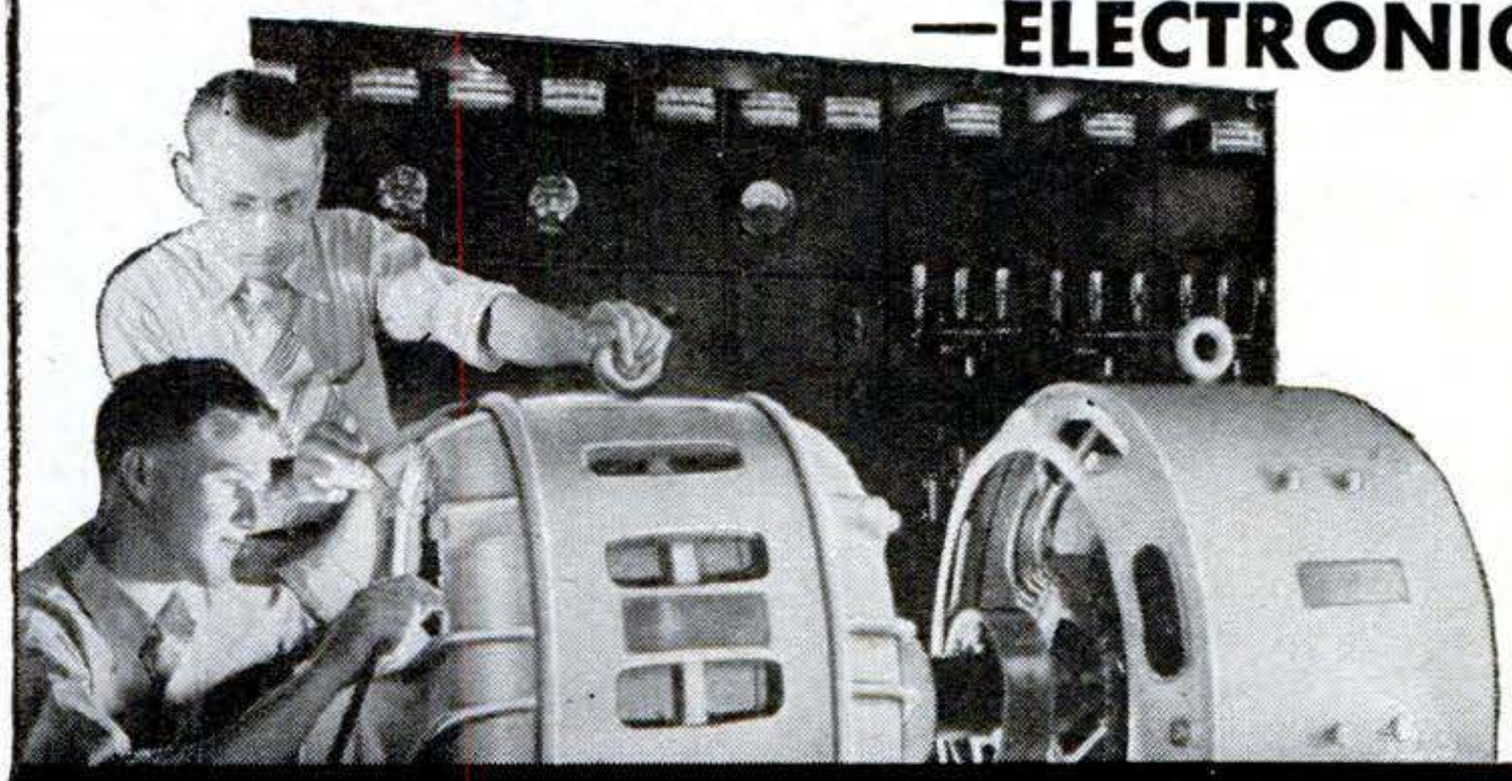

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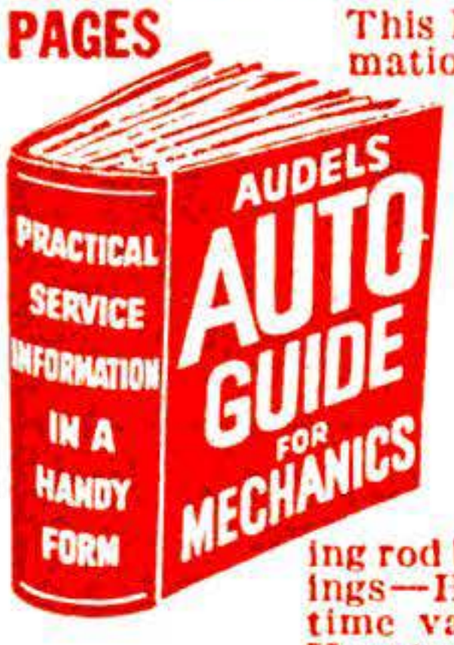

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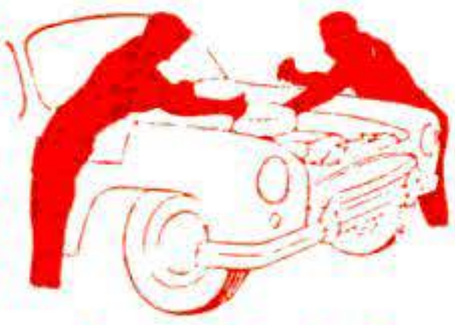

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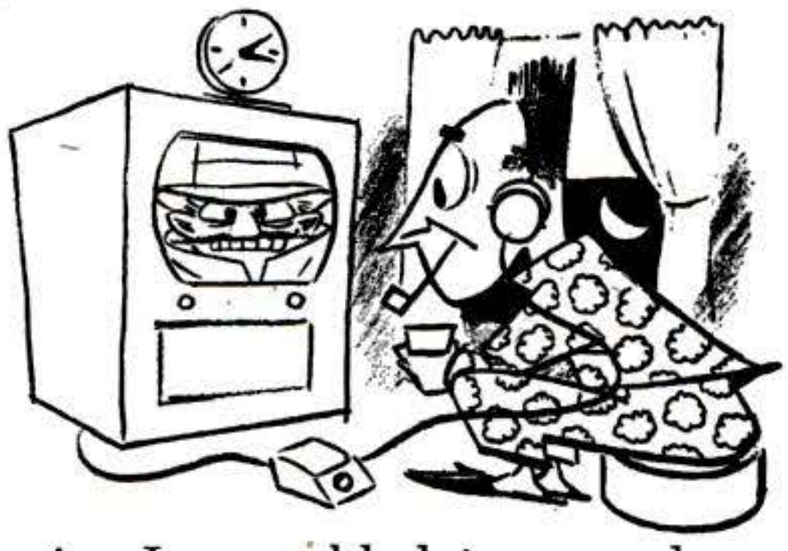
mont Speedway was a "drag" strip. Schmitt's cycle was geared down for dig-out, not for maximum top speed.

As far as top speed is concerned, a single-motored, American-made Harley-Davidson bike recently hit 170.13 m.p.h.

KEN KIELAR, Chicago

Now He Likes His TV Better

Just a word to report how pleased I am with the television remote-control-and-listen-



ing device I assembled in accordance with the data outlined in the article titled "Television as You Like It" [May, p. 216].

KARL T. DREHER, Denver

Lightning-Fast Reader

You reported in June [p. 159] that George Murch of Denver University is capable of seeing 8,000 words per minute pass before his eyes and then score 100 in a test on the subject he has read. That's a lot of literature. It's 133.333 words per second. That's better than "amazing." I just don't believe it!

DAVID K. MILLER, Trenton, N.J.

Our information on Mr. Murch's feat came from the usually reliable United Press. Obviously, nobody but an electronic brain can read 133.333 words a second—one at a time. But the Air Force, among others, has found that people can be trained to read very rapidly by taking in a great many words at each glance.

Taking Issue with an Artist

Just love that Gus Wilson. His combination of kindness and know-how makes him the Rolls-Royce of mechanics. The illustrator of the June story [p. 160] must have forgotten his Model A Fords, however. They had no oil-pressure gauge. Gus couldn't have made his deduction on the Model A in the picture.

JAY MONROE, Flushing, N.Y.

How do you know that the old boy in the story hadn't bought an oil-pressure gauge from a mail-order house?

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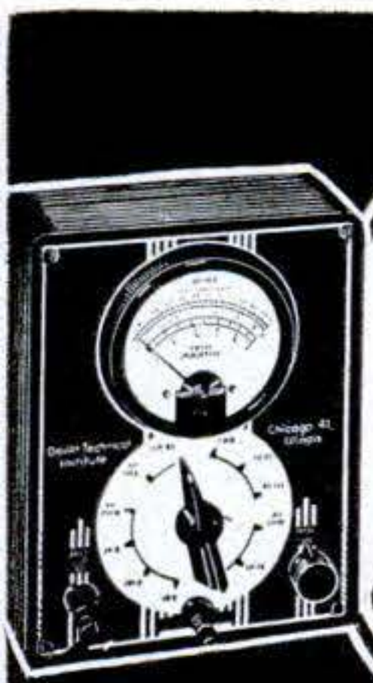

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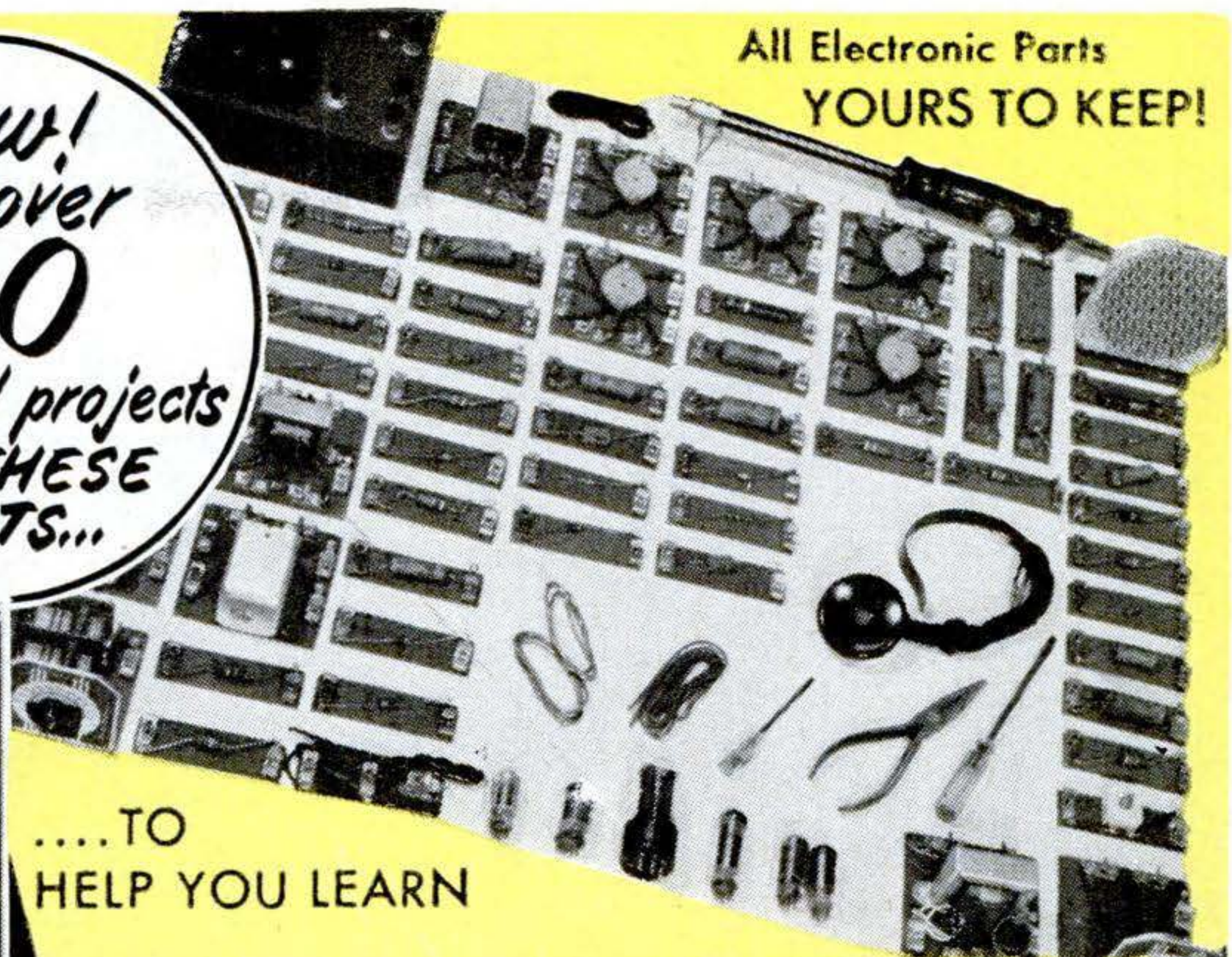

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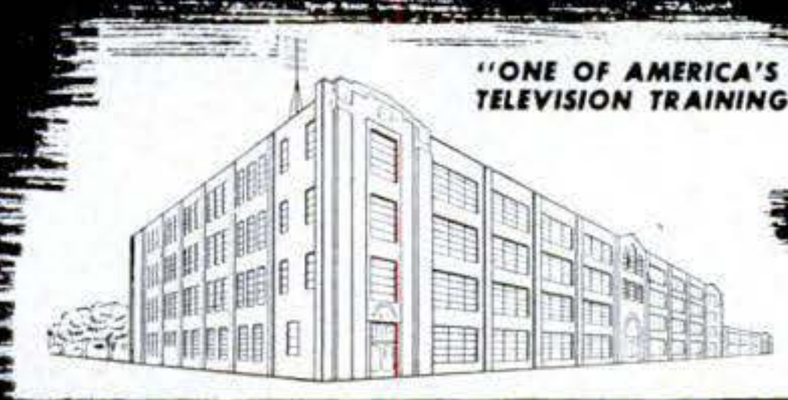

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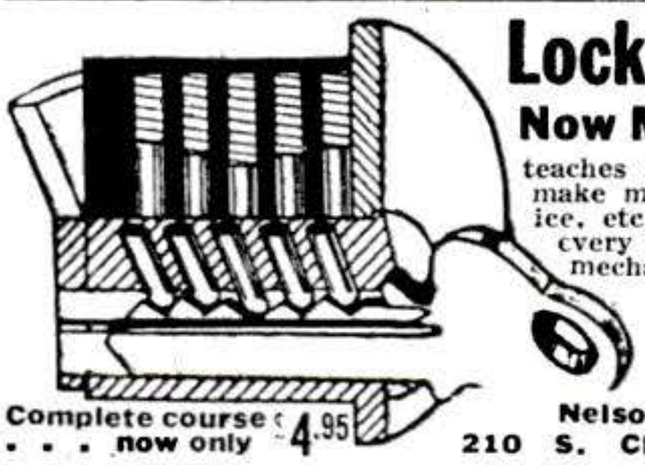

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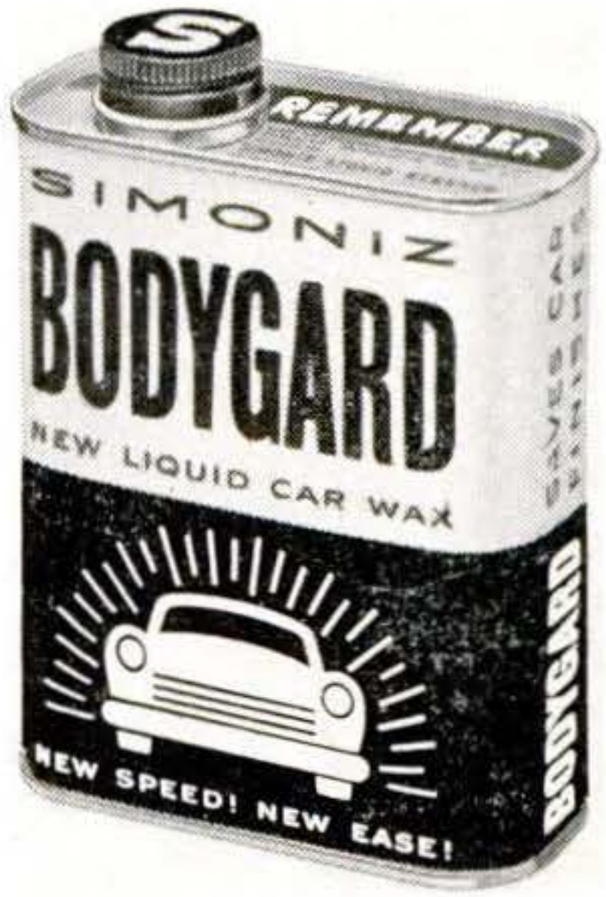

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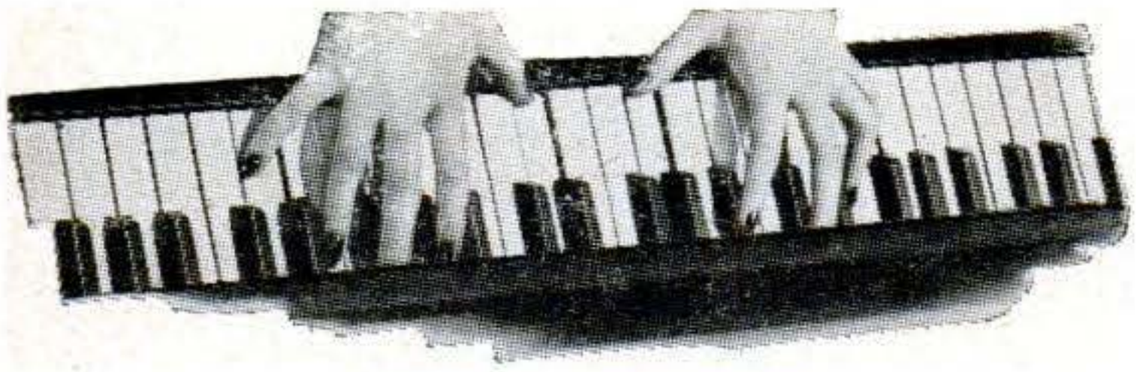

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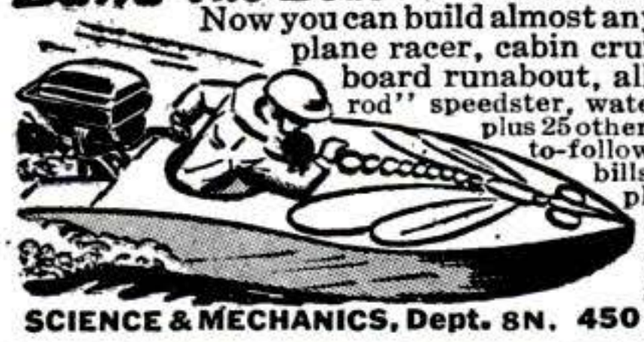

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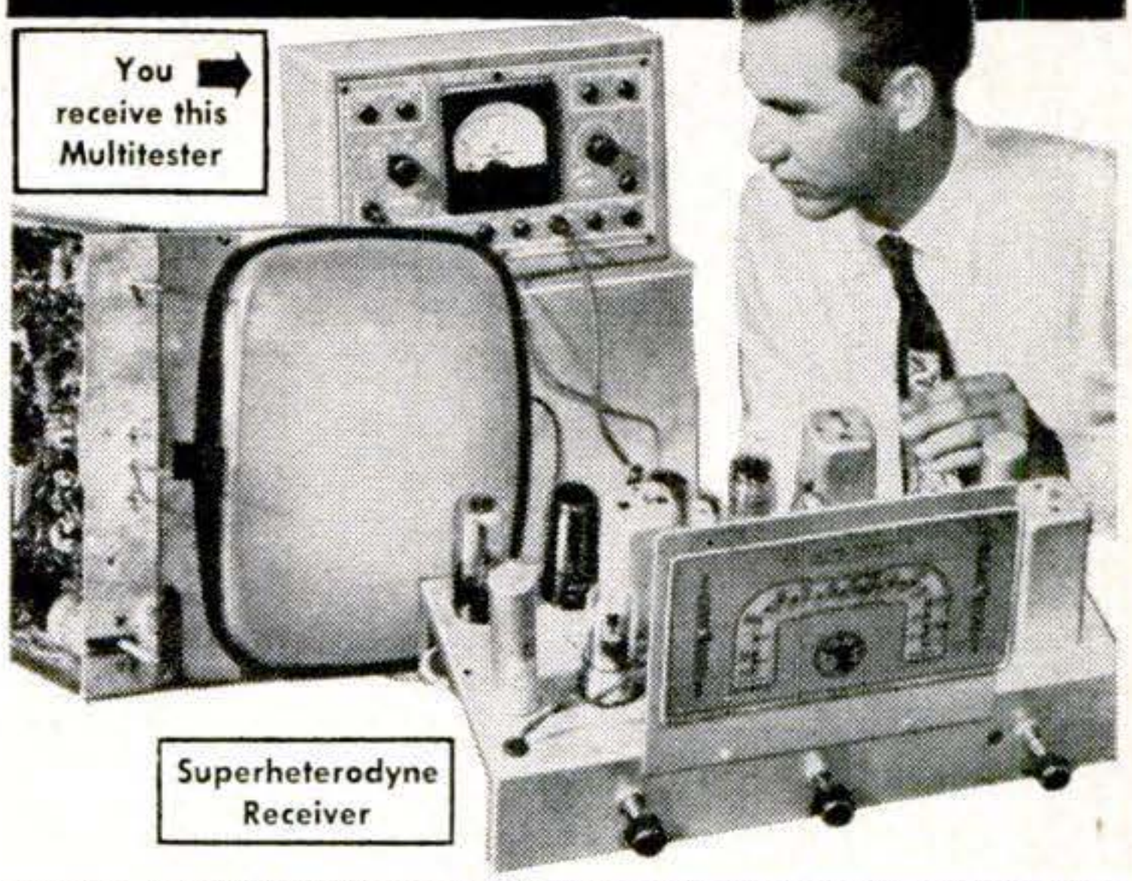

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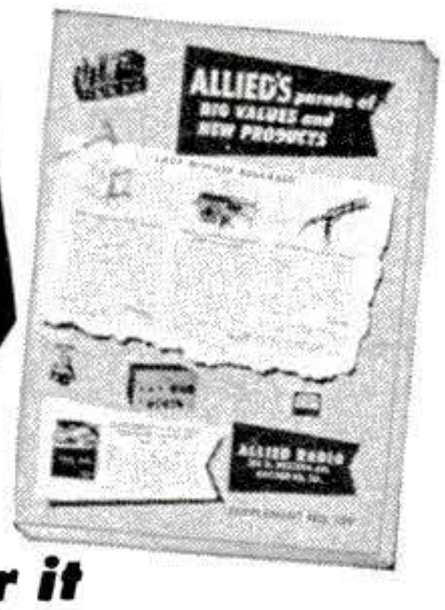

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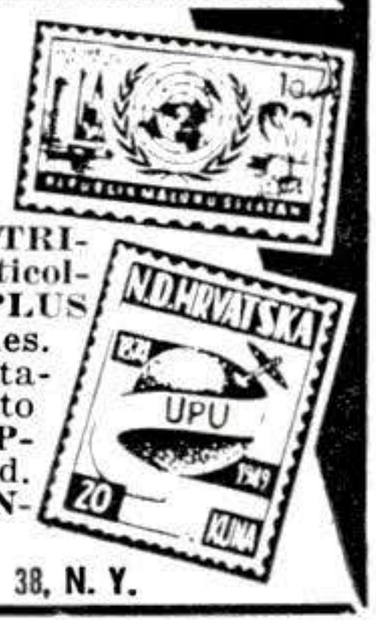

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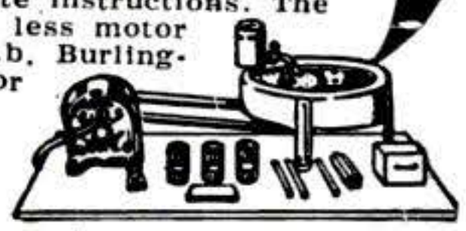

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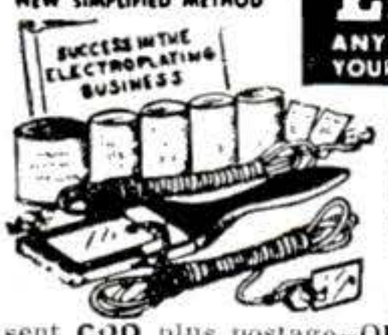

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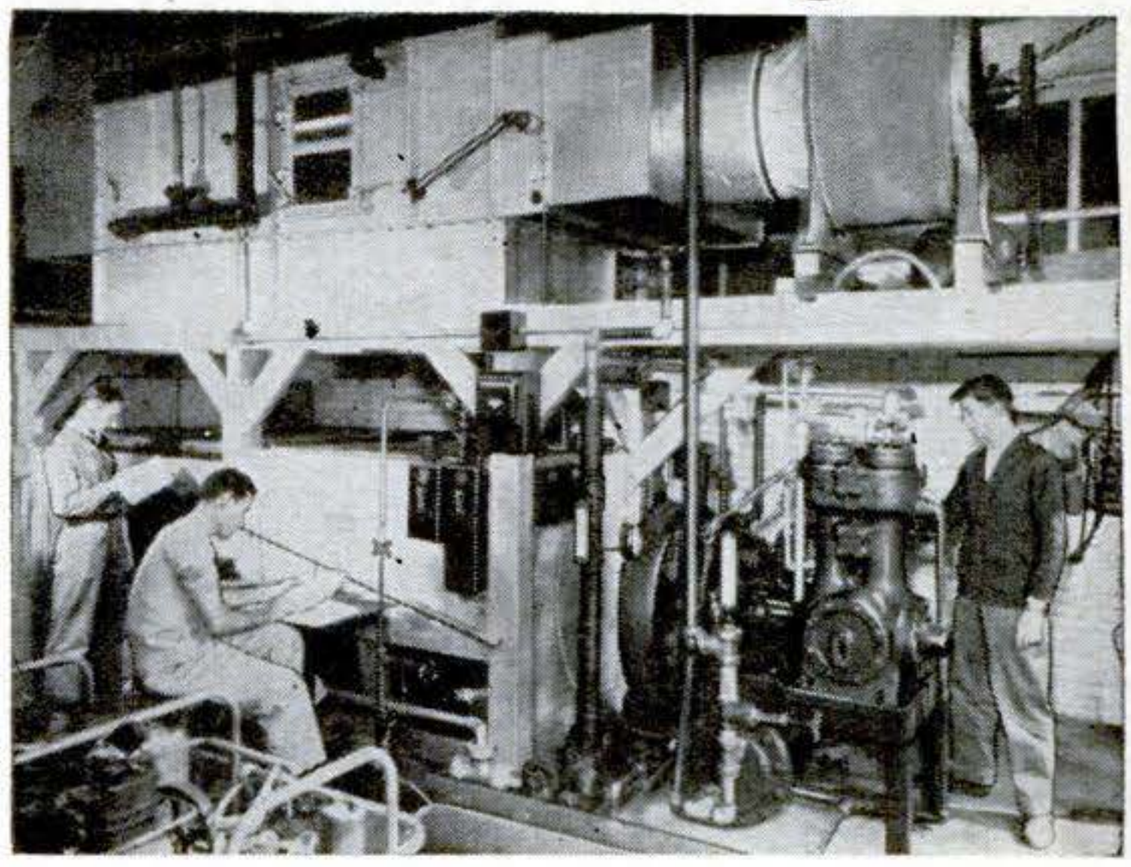

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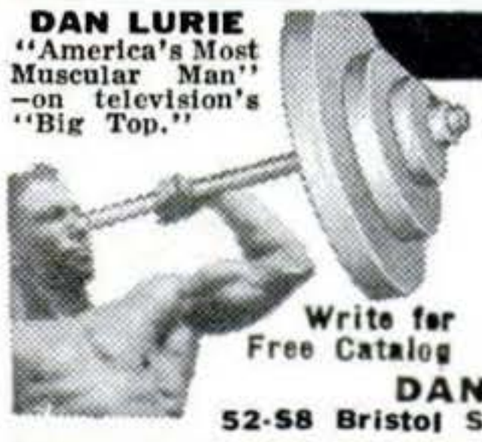

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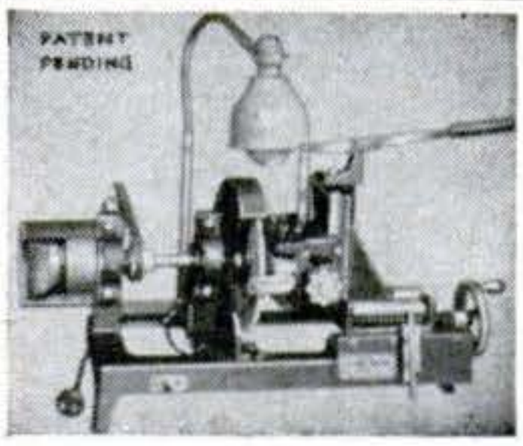

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700x16	6.15	760x15	5.75	750x15	10.45	900x20	17.65
750x16(6)	8.35	800x15	6.05	825x15	10.45	1000x20	16.55
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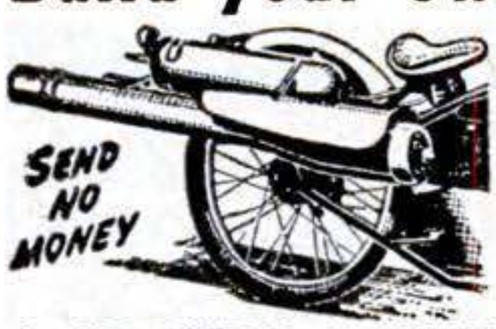

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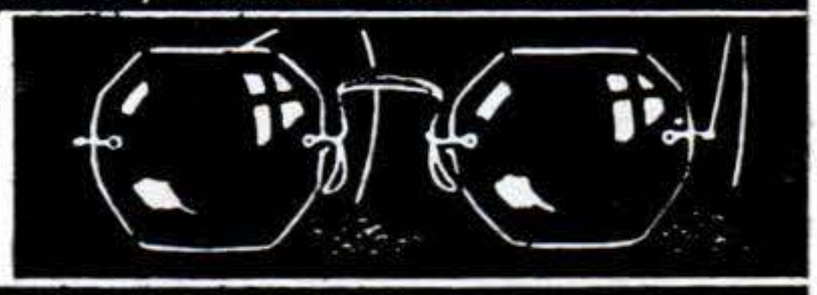

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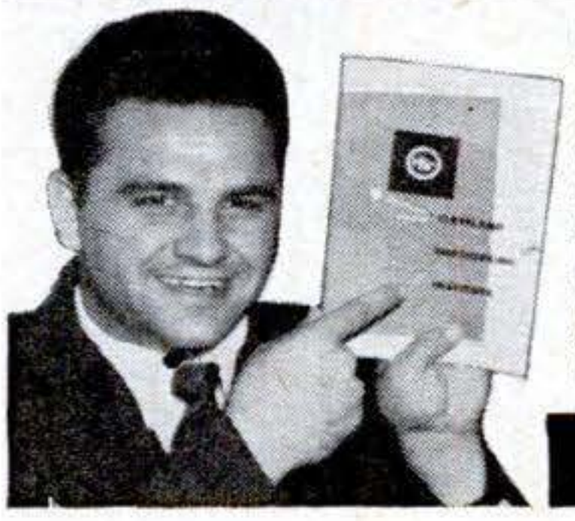

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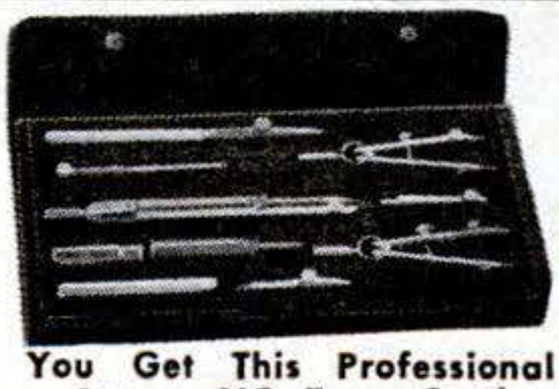

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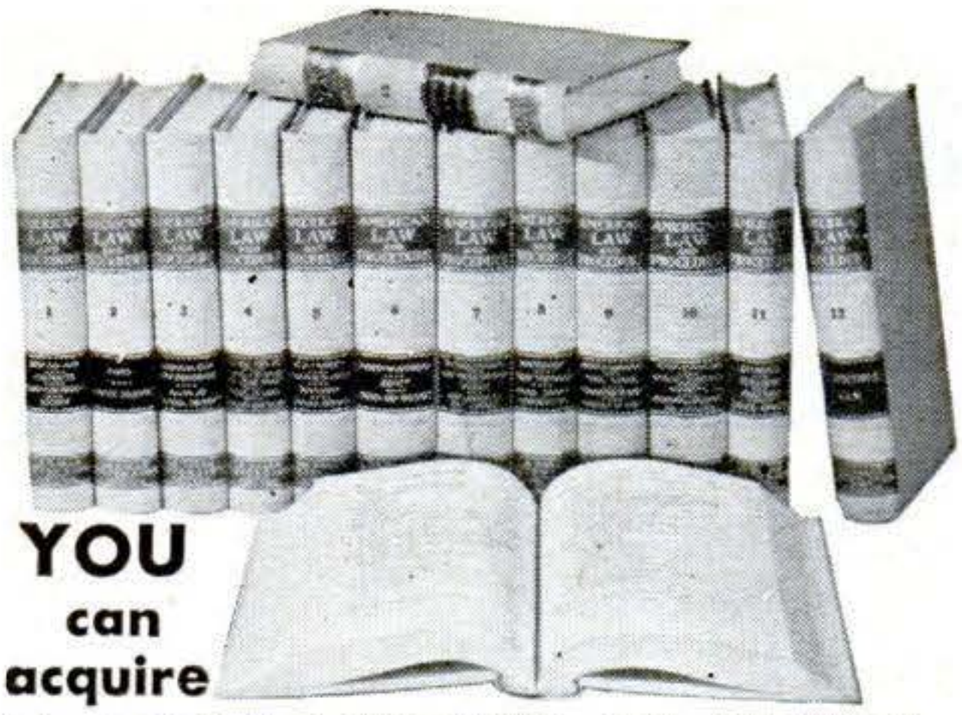

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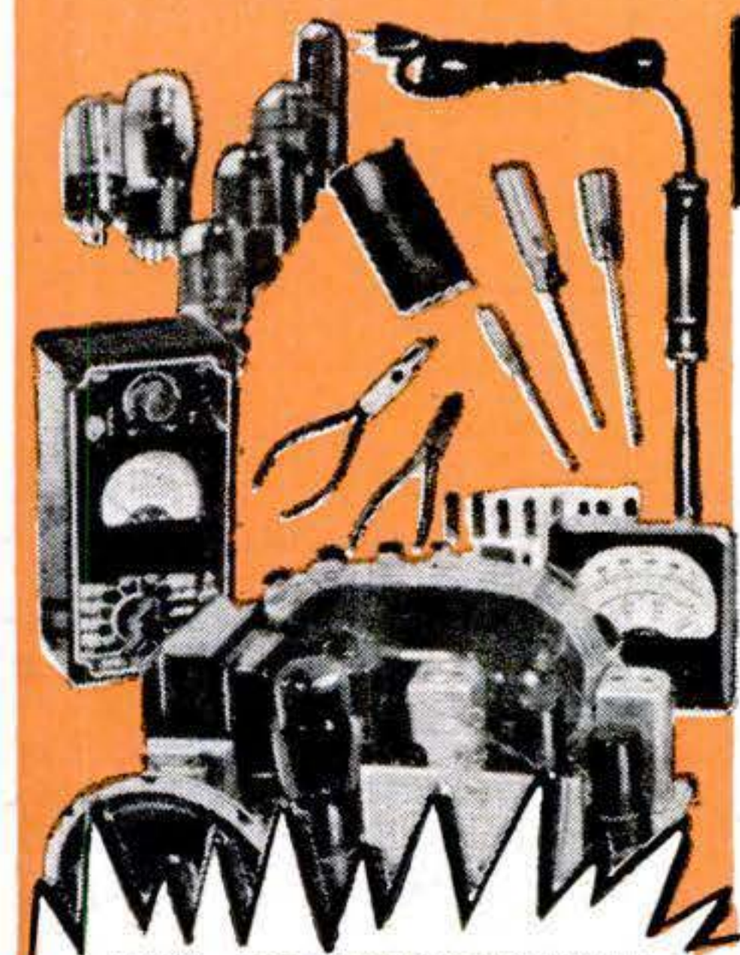

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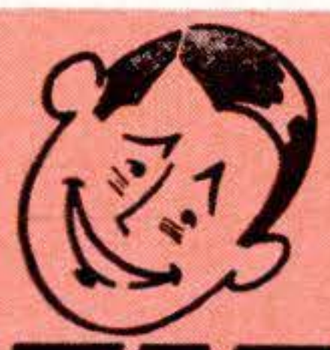

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BEAUTIFUL Results at low costs. Jumbo Oversize finishing. Quality workmanship. 8-exp. roll superfine finish only 40c. 12-exp. 55c. 16-exp. 70c. 36-exp. $1.50. Oversize reprints 5c each. Send us your order. Free Mailers. Mailbag Film Service. Box 5440A. Chicago 80. Illinois.

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TWENTY Wallet Size Prints any photo $1. Empire. Box 33. Baldwin. New York.

33 MOTION PICTURES, SLIDES, SOUND EQUIPMENT

GUARANTEED Fresh 8mm roll. magazine; 16 mm roll. magazine movie film. Color. b&w. Free catalog. Eso-H. 47th Holly. Kansas City 2. Missouri.

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MOVIE Camera Film: 8 mm roll $1.50. 16mm 100' $3.00. Free processing. Better Films. 742 New Lots. Brooklyn. N. Y.

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FREE Record of your song—Your words—My melody. Free information. Johnny Mack's Melody Mart. 1094 West 39th Street. Dept. K. Los Angeles 37.

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AMATEUR Songwriters! Top - Notch Broadway Staff Offers expert professional opinion—suggestions for improving your song or lyric. Enclose $1.00 with each manuscript or recording. Amateur Songwriters Workshop. P.O. Box 359B. Times Square Station. New York 36. New York.

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SONGWRITERS! Send poems. songs. Music Service. 243 West 72nd St.. PS. New York 23.

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FREE list. Builder's pictorial construction plans. Alena, 286 East Broadway, New York 2.

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COLOR Television! Enjoy low cost 3 color Television screen now. Easily attached. Free descriptive circular. Zingo Products, Johnstown 99, New York.

REPAIR your own TV! Instructions $2.00. Ray Television Service, P. O. Box 592, Radford Virginia.

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BREED Rare Tropical Fish at home. Earn Big Money! Learn Secrets! Help fill huge demand. Amazing Opportunity! Free Plan. Tropicals, 1008-G Los Angeles St., Los Angeles 15.

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NOTARY Public appointments. Our 25th year. Inquire: Stationers, Helotes, Texas.

MEN Wanted—Build Luggage And Cases At Home. We sell your products—supply complete instructions, materials, everything. No special equipment needed. Free details. Casecraft, 805-H8 Sunset, Los Angeles 12, Calif.

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GUARANTEED moneymaker at home, work, school, etc. Write for sample offer. Petee's, Box 833, Toledo, Ohio.

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MAKE money at home. Write. Falcon House, Winnebago 4, Illinois.

FREE Folio "$45,000; Unlimited Vacations Plan." No canvassing, mailorder, merchandise, equipment. Unknown. Works itself—home! Keep job. Haylings-PS, Carlsbad, Calif.

MAKE Big Money Raising Parakeets for our market. Positively no selling. Birds, instructions furnished. National Aviaries, Box 4097-S, San Diego 4, California.

MAKE big money at home. No investment. We supply everything. Full details $1.00. Blind Industries, 3398 Frederick, Detroit 11, Michigan.

UNLIMITED Earnings, operating practical mailorder plan; small capital, details free. Llanerch Sales, 24 E. Langhorne Ave. Havertown, Pa.

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GROW Mushrooms. Cellar, shed, and outdoors. Spare, full time, year round. We pay $3.50 lb. We paid Babbitt $4,165.00 in few weeks. Free Book. Washington Mushroom Ind., Dept. 179, 2954 Admiral Way, Seattle, Washington.

EASY living mailorder method brings high income monthly. Others work for you. We supply everything. Complete instructions and sample $1.00. Dar-Craft, Box 268, Monroe, Washington.

FUTURE Security! Learn Watch-Clock Repairing at home. Inquire. Modern Technical Supply, 55-PS West 42nd Street, New York 36.

$15 AN Hour preparing tax returns. Experience unnecessary. Details Free. Union Institute, 1M, Lakewood, N. J.

39 FORMULAS, PLANS, ETC.

FORMULAS—All kinds. Latest products. Literature free. Kemico, Park Ridge 15, Ill.

FREE Formula Catalog. Anything analyzed $35.00. Western Chemical, Salem, Ore.

LATEST modern real manufacturing formulas, list free. Moon, Martville, N.Y.

FORMULAS, $2.50. Richard Hein, Chemist, 250 Argyle Street, Valley Stream, New York.

MODERN formulas for today's fastest selling big-profit products. Literature free! Miller, Chemist, 1517-A, Tampa, Florida.

40 PLASTICS

PLEXIGLAS. Lucite. Any size sheets. Square foot (12x12) cost, 1/16", $1.18; 1/8", $1.55; 3/16", $1.90; 1/4", $2.25. Add 15% for postage. Minimum order $3.00. Almac Plastics, 600 Broadway, New York City.

PLEXIGLAS sheets—cut to size—clear, all thicknesses—standard outdoor translucent colors. McClarin Plastics, P.O. Box 168B, Hanover, Pa.

PLEXIGLAS, Fiberglas, Polyester, Acetate, Vinylite: Casting, coating plastics: Fast service, wholesale-retail prices. Catalog 10c. Gem-O-Lite, Box 6862P, North Hollywood, California.

PLASTICS home-craft course for Men and Women. Tells and shows how to make hundreds of fast selling plastics products. All plastics and materials for 23 projects included in course. No special tools needed. Course pays for itself. Write for Free booklet. Interstate Training Service, Dept. D2-H, Portland 13, Oregon.

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FIBERGLAS-resin materials included in our complete plastics catalogue. Van Horn Plastics, 1905 Ingersoll, Des Moines, Iowa.

41 CHEMICALS & APPARATUS

SEE Cosmic Rays. Watch Radio Activity At Work. Laboratory Certified Cloud Chambers $9.75. Free Brochure. Atomic Laboratories, Box 343, Berkeley, California.

NEW Idea Chemical and Apparatus Outfits for Home Experimenting Photo-Scales, Microscopes, Chemicals, Biological and Laboratory. Supplies in Small Quantities. Catalog 25c. Established 1931. John H. Winn, 124-B West 23rd Street, New York, N.Y.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology 20c. Tracey Laboratories, Evanston, Illinois.

CHEMICALS and apparatus for industrial, analytical and private laboratories. Catalog 25c. Dept. M-26, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N.Y.

GEIGER Counters, $29.95 up. Free Catalog. Atomic Laboratories, Box 343, Berkeley, California.

42 HELP WANTED

FOREIGN & Latin American Employment 1954 "Foreign Service Directory" gives Up-To-Minute Facts on Military & Civilian Construction, Government Jobs, Major Oil Listings, Aviation, Transportation, Steamship Lines, Mining, Importers, Exporters, How-When-Where to apply application forms. Hot List Firms Hiring. $1.00 postpaid. Global Reports, Box 883-S, Hollywood 28, Calif.

ALASKA!! Last American Frontier. $1.00 brings 1954 Business Directory & Government Map, Military & Civilian Construction; Homestead & Highway facts; Mining, Aviation, Fur Farming, Grazing, Timber, Travel directions. List of firms hiring. How to apply. Alaska Opportunist, Box 92-S, Hollywood 28, Calif.

ADDRESS Advertising Postcards. Must have good handwriting. Box Nine, Watertown, Mass.

CALIFORNIA Employment. California's population increasing over 400,000 a year—become part of it. Have a job waiting your arrival. Complete listings, information, $1.00. Satisfaction guaranteed. Midcentury, Box 48461, Los Angeles 48, Calif.

FOREIGN — U.S. Jobs — So. America, Alaska, Spain. Fare Paid. 1000's U.S. jobs to $18,000. Trades, Office, Factories. Send stamped self-addressed env. Job Opportunities, Waseca, 2G, Minnesota.

MIAMI Help Wanted Columns leading newspaper, airmailed $1.00. Box 71, Miami 50, Florida.

SOUTHERN California—Job opportunities, or Business opportunities, Real estate and Rentals. Air Mailed—$1.00. Arnett, 1923—8th Avenue, Arcadia, Calif.

MEN Wanted Now for Foreign Construction employment on American Bases in Europe, South America, Far North and other countries. Truck Drivers, $3.55 hour. Clerks, $3.00 hour. Carpenters, $3.70 hour. Laborers, $3.00 hour. Many other trades wanted with wage rate accordingly. Up to 70 hour week with time and one half for all over 40 hours. Transportation paid. 8 to 24 month contract. Also jobs with Ship, Oil, Mining, Aviation Firms and construction jobs in U.S.A. with wage rate in 71 of the larger cities. Full information of all Firms hiring, jobs open, wage rate, sample contract, medical examination, application form, etc., Air mailed to you for only $2.00. Foreign Construction Bulletin, P.O. Box 393, Dept. 28, Dallas, Texas.

$245 PER Week overseas! Clerks, truck drivers, cooks, construction men, guards, office workers, laborers, carpenters, electricians, mechanics, engineers, teachers, factory workers, many other classifications. No experience needed, some jobs. 257 projects, 51 countries. Plus latest bulletin, "Firms Seeking Applicants". Complete information, illustrated, 56 pages, applications, $1. Jobservice, D-1, Box 30, Billings, Montana.

$1300 MONTHLY for truck drivers, $1400 monthly for carpenters, electricians, plumbers, mechanics, $1200 for clerks and laborers. Replacement hiring now being done. Full information and complete foreign listings, with current information on Spain, Korea, Australia, Alaska & Canada, $1.00. 10,000 men and women needed for new stateside project! Complete information and other domestic listings, $1.00. Dept. 4-H. Opportunities Unlimited, 1110 Commerce Bldg., St. Paul, Minnesota.

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LATEST employment information Greenland. Interest Rehires. Spain, Alaska many others listed, $1.00. Foreign Job Information Service, Box 657, Minneapolis, Minnesota.

CHICAGO has the jobs. Help Wanted columns airmailed $1.00. Mortensen, Box 5417, Chicago, Illinois.

NORTHERN Jersey Help Wanted and Housing columns $1.00 airmailed. Adservice, 327 Steilen Avenue, Ridgewood, N. J.

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CHRISTMAS Cards pay 75c profit on $1.25 assortment. Exclusive 40 for $1 Name Imprints; Gift Wraps By-The-Yard; 200 new fast-sellers. Cash bonus. 5 Assortments on approval. Cardinal, 1400 State, Dept. 80-L, Cincinnati 14.

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ANYONE Can Sell famous Hoover Uniforms for beauty shops, waitresses, nurses, doctors, others. All popular miracle fabrics—nylon, dacron, orlon. Exclusive styles, top quality. Big cash income now, real future. Equipment free. Hoover, Dept. E-101, New York 11, N. Y.

BIGGER Profits selling Greeting Cards. Get list of sensational Factory Surplus Bargains. $1.25 boxes for 50c, $1 boxes for 35c—while they last! Big line new 1954 Christmas Cards, Stationery, Gifts. Assortments on approval. Personalized Samples Free! Midwest Cards, 1113 Washington, Dept. H-136, St. Louis, Missouri.

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AMAZING Profits For You selling Sunshine Quality Christmas Cards. No investment or experience necessary. Nationally Famous 21 Cards for $1.00. Sells on Sight! Imprints, Currier-Ives, Religious, Gift Wraps, many others. Samples on approval, write: Sunshine Art Studios, Inc., Dept. PS-8, Springfield 1, Mass. Pasadena 3, Calif. (Note: East of Rockies address Springfield Office.)

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RUN spare-time Greeting Card and Gift Shop at home. Show friends samples of our new 1954 Christmas and All-Occasion Greeting Cards and Gifts. Take their orders and earn to 100% profit. No experience necessary. Costs nothing to try. Write today for samples on approval. Regal Greetings, Dept. 105, Ferndale, Mich.

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GET Into Toys! Show sensational toy flannel-back tablecloth. Free toy gift line. Take orders. Juicy profits. Styleco, Dept. T455, Cincinnati 10, Ohio.

100 CHRISTMAS cards $2.25. Agents wanted. Wade, Box 3006, Greenville, Miss.

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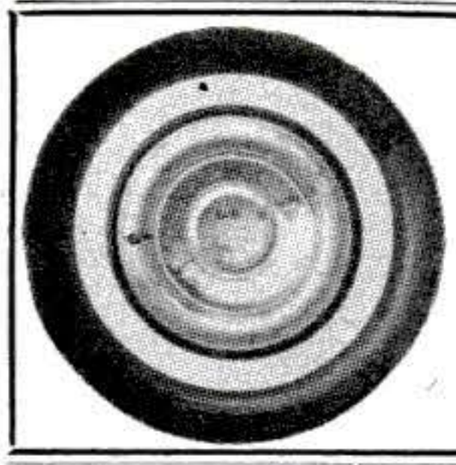

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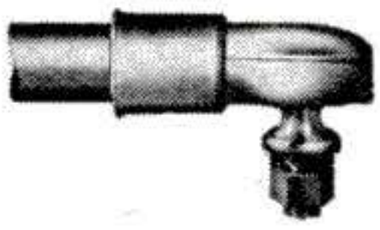

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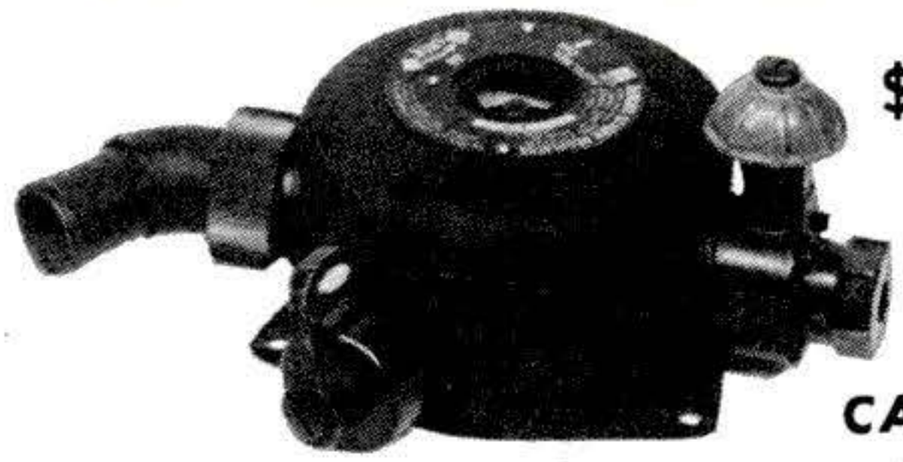

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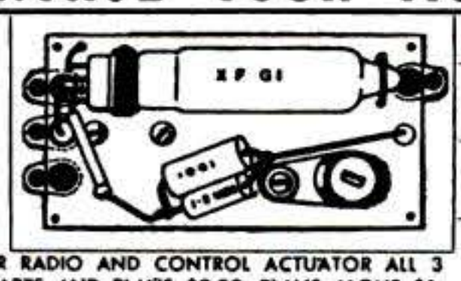

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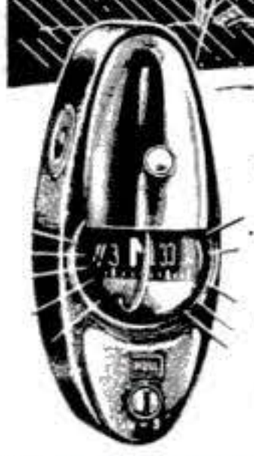

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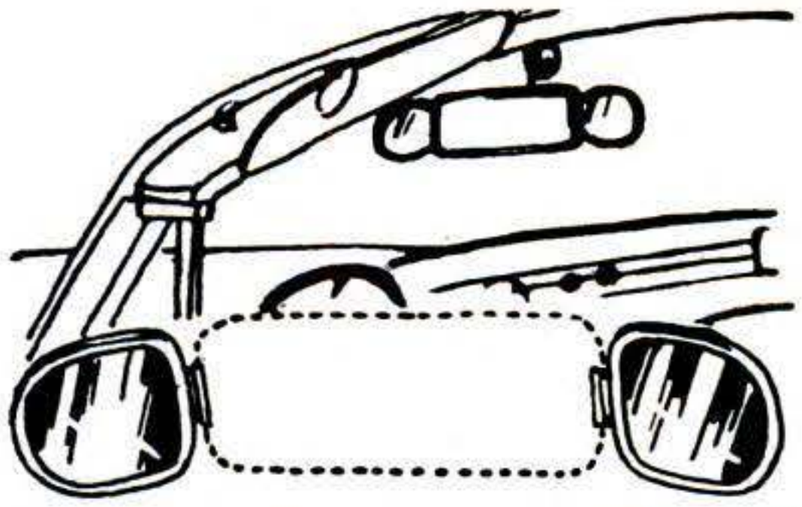

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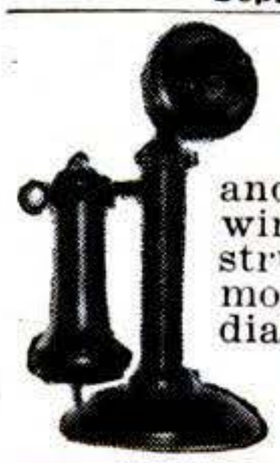

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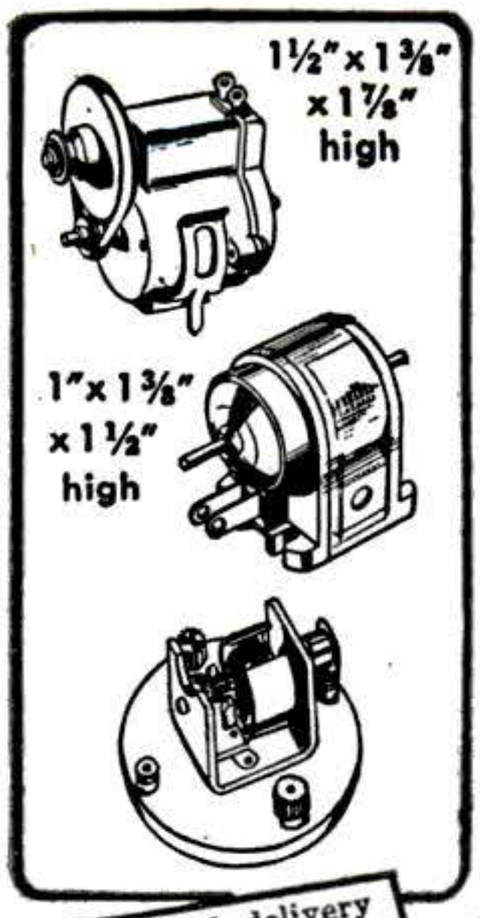

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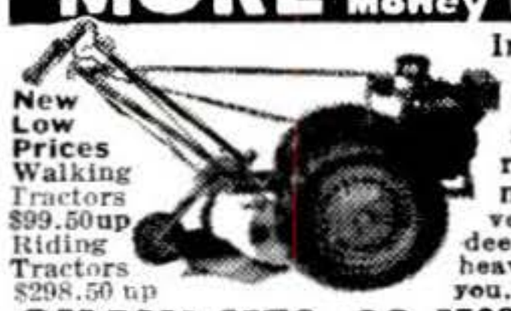

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NO POLICE PERMIT NEEDED

Looks like regular quality pocket pistol. Precision machined of regular gun steel to close tolerances by German gunsmiths. Has six shot magazine. Is double action and **fully automatic.** Positive safety catch. Ideal for home protection, sporting events, theatrical performances, dog training, etc. 4" long. Weighs 9½ oz. **10 DAY NO RISK TRIAL.** If dissatisfied return for refund. C.O.D.'s require $2.00 deposit. Cash orders pre-paid.

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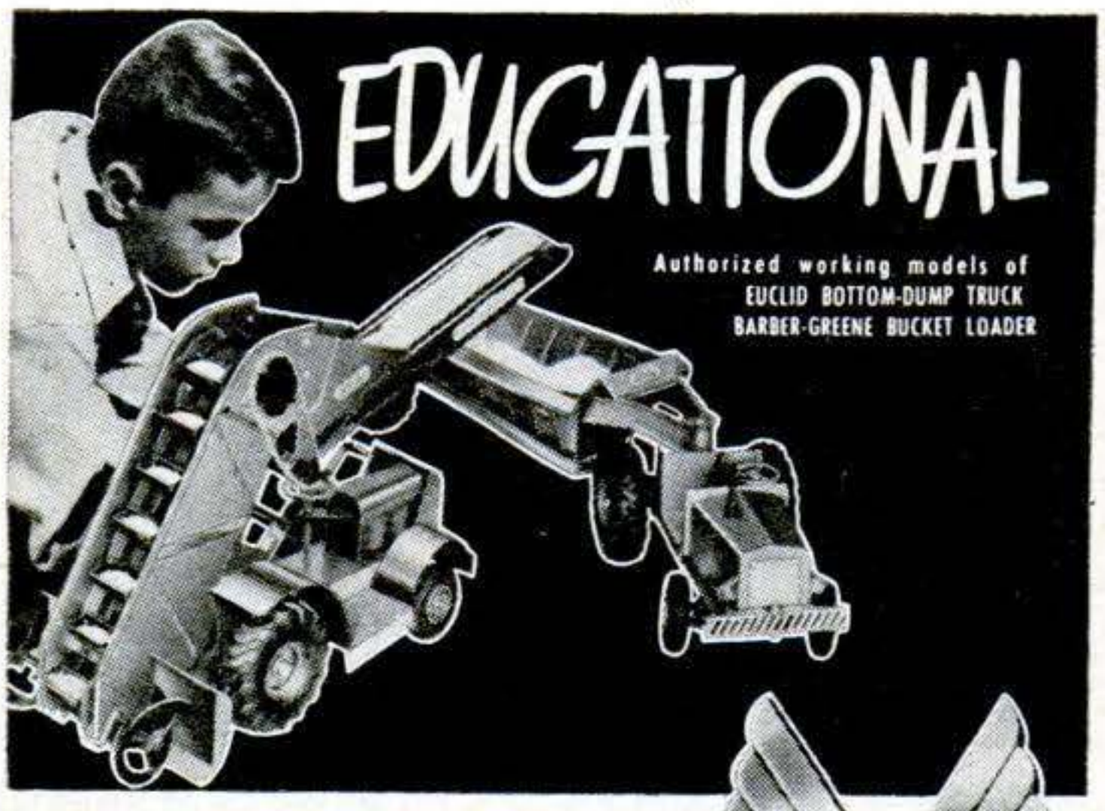

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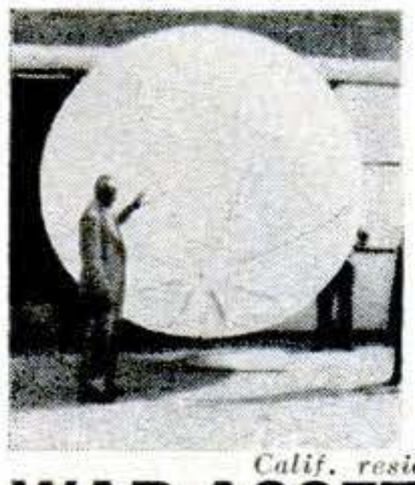

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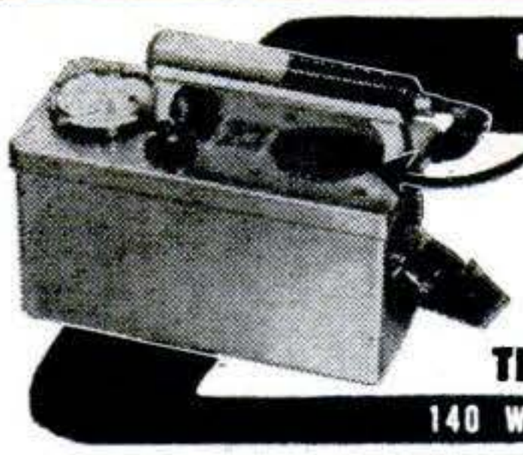

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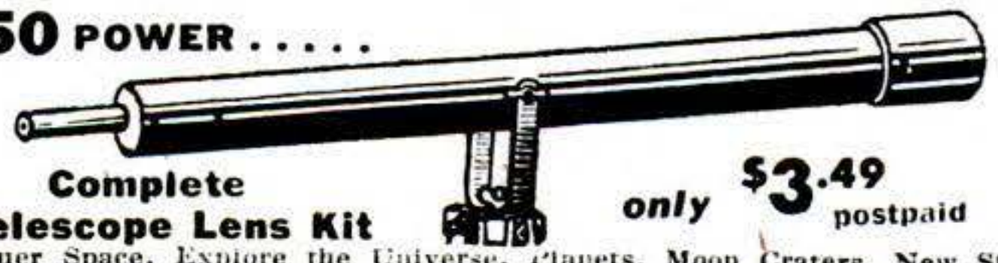

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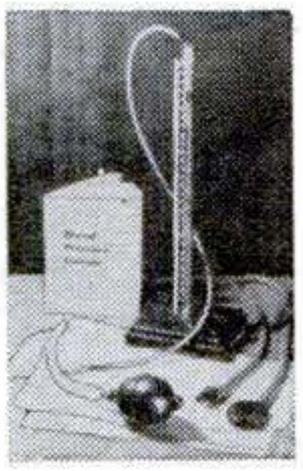

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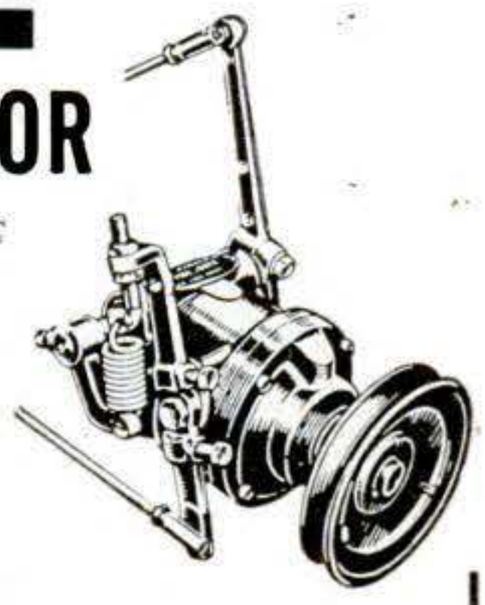

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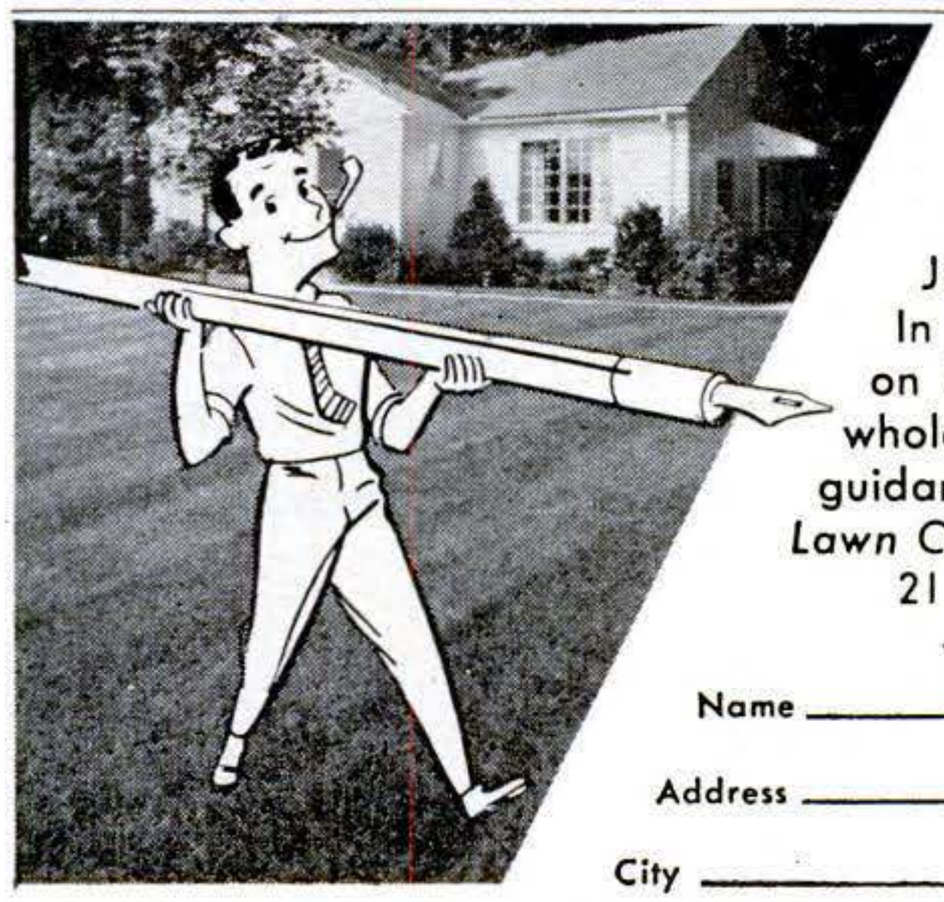

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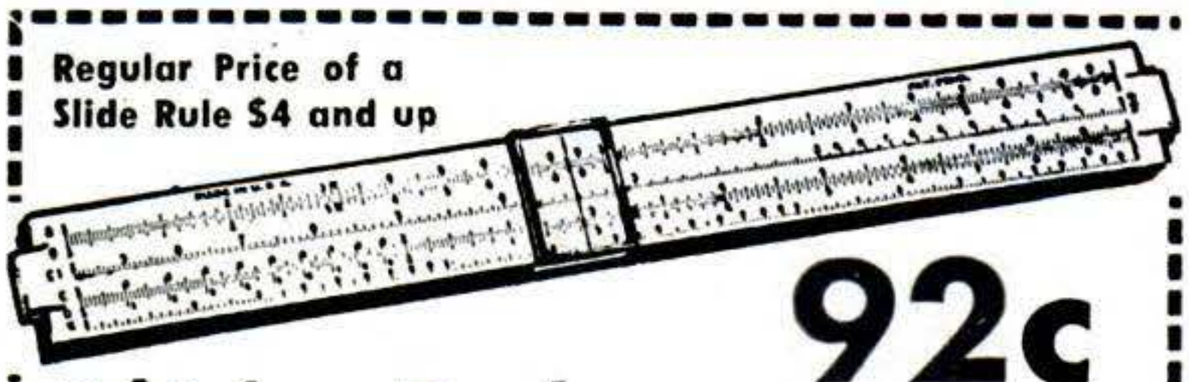

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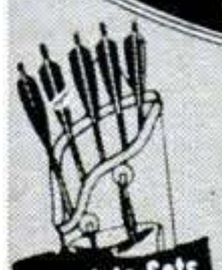

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Free! Mother of Pearl Handles with each EM-GE

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Write for pamphlet on larger fan blades, wire guards, fan bases, shutters, pillow blocks, exhaust fan frames, etc. Dealers write for discount. Add 10% for packaging and shipping. Shipped C.O.D. or cash with order.

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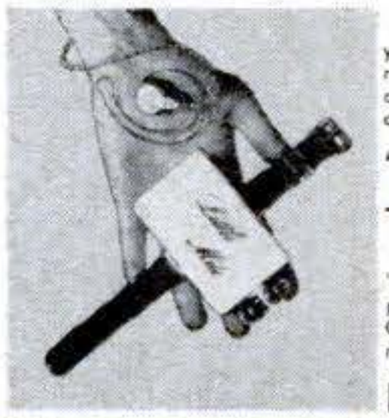

Amazingly powerful performer. Plays while you wear it. Build your own easily and economically. Standard parts available from regular radio supply store for about $10. New book, just published, contains complete information including detailed parts list, pictorial diagrams, and easy to follow step-by-step instructions.

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A basic kit comprising an attractive plastic case (pre-drilled), "outline" chassis, battery clip assembly, and hardware $1.98 postpaid. Combination of book and basic kit, special $3.50 pp. Complete kits and sets assembled on order. Send 25¢ for schematic diagram and descriptive folder.

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If a rusty radiator causes your engine thermometer to read high on moderate summer days, don't wait for a scorcher. Put in Du Pont Cooling System Cleanser right away. It cuts grease with detergent action, cleans out scale, and *dissolves* rust so that water drains out clear. And neutralizer in each can completes the job. Du Pont Cooling System Cleanser is *thorough, safe, simple.*

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Once your cooling system is clean, keep it that way with Du Pont Anti-Rust. This new liquid inhibitor retards rusting, inhibits acid formation and lubricates the water pump as well!

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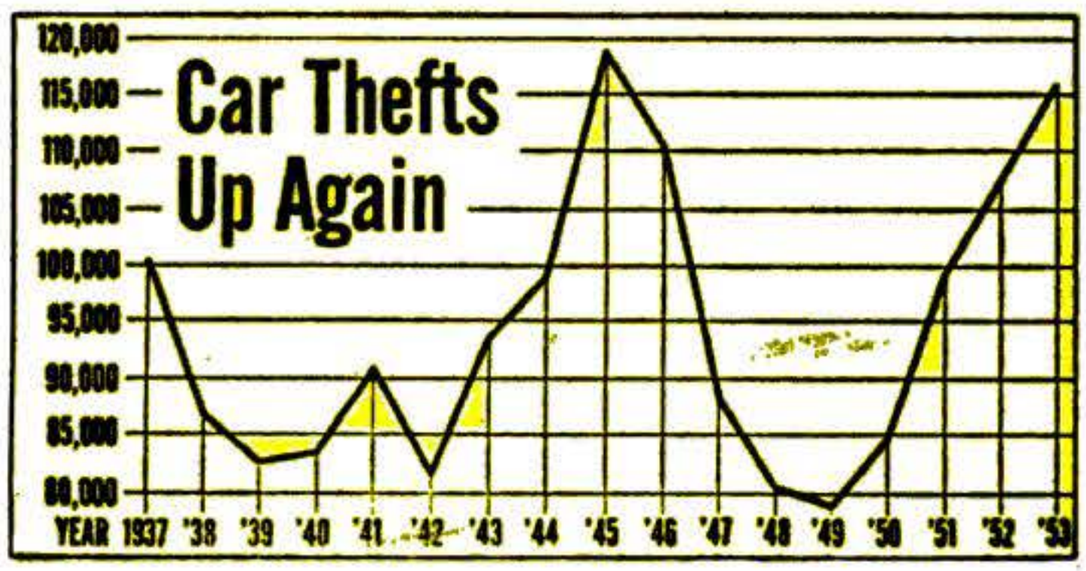
POPULAR SCIENCE MONTHLY'S . . . **Last-minute news & notes**

WEATHER REPORTS WHILE YOU DRIVE are now displayed along the Pennsylvania Turnpike. Automatic signs (connected to a rain-catcher, a temperature element and an electric eye that detects fog and smoke) show condition of the road ahead...Spare parts might be telegraphed anywhere in the world, suggests F. W. Cunningham of Arma Corp. Automatic machine tools can be controlled by patterns of holes punched in paper tape. These patterns, if coded for a teletypewriter, could be transmitted and used to manufacture the parts.

A "SUBMARINE" THAT DIVES, ROLLS AND TURNS BUT NEVER GETS WET will be built to train sailors. Operating much like Link airplane trainers, it will duplicate a real sub's control room. Electric Boat Co. is to build it...Another way to make electricity from sunlight has been invented by the Air Force. Unlike Bell Labs' solar battery (PSM, July '53, p. 71), which contains silicon, this one uses cadmium sulfide. A four-by-15-foot slab would supply an average house...3-D radar, a big help in controlling aircraft traffic, is being developed by several companies. Some proposed systems use mirrors or lenses to separate right- and left-eye images, eliminating polarizing spectacles.

A MUSICAL DOUBLE PLAY WAS OVERCOME at Chicago's outdoor concerts this summer by installing delay units in the loudspeaker system. Audiences had complained that they had to listen to the music twice, first from the loudspeakers and then from the band shell itself. To cure this, the delay units now record the music on tape, pause a moment, then run it off through the speakers so that sound from both speakers and shell reaches the listeners simultaneously...An "electronic doctor" will watch over patients on the operating table at one hospital. It keeps a continuous check on blood pressure, heartbeat and breathing. Thus the surgeon can know immediately if trouble develops. The Physiological Monitor was made for the Veterans Administration by the Bureau of Standards...



Watch your car closely, warns the FBI. Auto thefts, which dropped after a wartime high, are climbing sharply again (see chart at left, prepared from FBI statistics on city crime).

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Reading time: 3 minutes to learn how to

- **cut engine wear up to 38%**
- **prevent loss of power, compression**
- **save 15%-25% on oil . . . without ever changing your oil filter**

This Gadget is Worth $320,000,000

...and I Discovered it by Accident!

by Albert Wells

IT ALL STARTED the day I got the bill: $214.36 for an engine overhaul—and I had only 28,000 miles on the car!

I told my troubles to a neighbor—a lubrication engineer—told him how I'd always changed oil every 1500 miles, changed filters every 5,000 miles. His answer floored me.

"You've been wasting your money," he said. "We've spent millions developing oil additives that keep carbon, gum and abrasives from damaging your engine. Your oil costs about 15¢ more a quart because of those additives. Yet oil filters on the market today are made of rag or paper—they soak up additives like a blotter. The more often you change oil filters the more money you waste!"

"But don't I need a filter to take the impurities out of the oil?" I asked.

He took a deep breath. "This will really shock you. Engine damage is done by abrasives 10 to 40 microns in size (a micron is .000039″). Your oil filter can't take them out because rags or paper can't be packed tight enough without stopping oil flow when the fibers soak up oil and expand."

"Isn't there any kind of filter that does the job it's supposed to do?"

"No, except for the porous bronze filters they're making for supersonic aircraft. And you can't buy a filter like that for your car."

I asked myself: "Why not?" Next day, I tracked down the outfit that was making the filters for aircraft, and got the answer. These porous bronze filters were made by fusing together millions of tiny bronze balls. Non-absorbent, they didn't remove additives, yet they removed abrasives in the 10-to-40 micron danger zone. Could they be made for automobiles? Again, the answer floored me.

LIFETIME FILTER TESTED IN CARS, TRUCKS, BOATS

Test models had already been used in cars and trucks for millions of miles, proving the porous bronze filter: 1. Never needs replacing. 2. Saves the quart of oil thrown away with ordinary filter packs. 3. Increases engine life.

Trouble was, almost the entire production was being absorbed by military and industrial users.

That day I went to work on the biggest job of my life: setting up production of the Lifetime porous bronze permanent filters for cars and trucks (an estimated $320,000,000 replacement industry).

HOW TO GET A LIFETIME FILTER FOR YOUR CAR

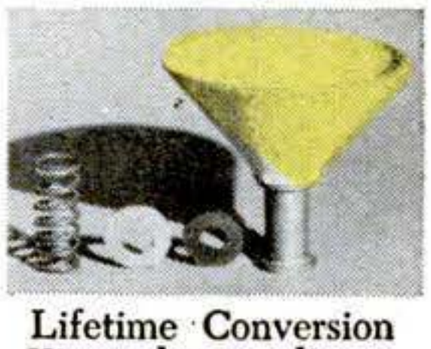
Try the Lifetime filter on your car for 2 weeks: if it isn't all I say, you get your money back; if you keep it, you're through buying filter packs—the Lifetime filter is guaranteed for 10 years.

For complete unit, including case (install on any car in 10 minutes), send make, year and model of your car and $12.95 (we pay shipping).

For conversion kit, which replaces your present filter pack with Lifetime bronze, send make and number of filter and $6.95 (we pay shipping). NOTE: a few cars have full flow systems; conversion kits for these are $13.95.

Or send only $2 deposit, pay rest C.O.D. But do it today—don't waste another cent on filter pack replacements!

Complete Lifetime Filter; fits any car.



Lifetime Conversion Kit; replaces ordinary packs with permanent bronze element.

OPPORTUNITY FOR DEALERS AND DISTRIBUTORS

A dealer and distributor network is now being formed to handle demand generated by advertising and editorial features in national magazines. If you can qualify, you can be first with the most exciting automotive product of this decade, to win new customers and build a substantial business. These valued franchises are not being sold; they are awarded on the basis of ability to grow with us. For complete details, write or wire: Continental Manufacturing Corporation, Dept. FPS-8 Washington Blvd. & Motor Avenue, Culver City, Calif.

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Permanent Filter Division, Dept. FPS-8
CONTINENTAL MANUFACTURING CORP.
Washington Blvd. at Motor Ave., Culver City, Calif.

Ship ☐ complete unit for_____
make, model, year of car

☐ conversion kit for_____
make and number of present filter

I enclose ☐ $12.95 for complete unit ($18.95—chrome)
☐ $6.95 for conversion kit (full-flow, $13.95)
☐ $2.00 deposit; send C.O.D.

Name_____

Address_____

City_____ Zone_____ State_____

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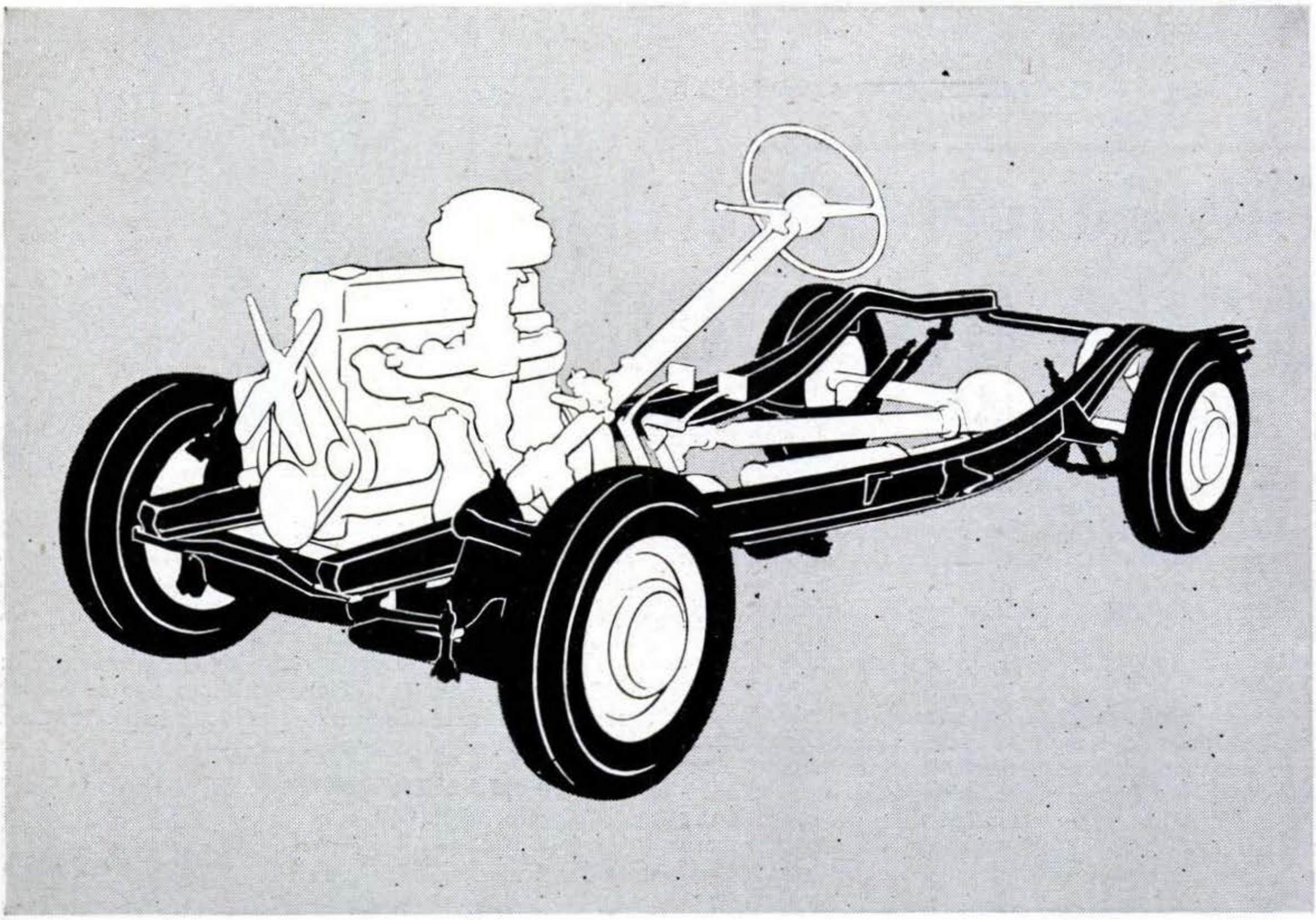

Advanced Chevrolet Engineering brings

BALANCED CAR SUSPENSION

for greater riding comfort

Behind Chevrolet's big-car riding ability is a lot more than just a suspension system. Actually it's a balanced combination of size, weight, weight distribution, tires *and* suspension system design that gives you that smooth ride you *expect* of a Chevrolet.

First of all, Chevrolet offers plenty of room in its wide, comfortable seats, cradled between front and rear wheels where they're least affected by road bumps. Chevrolet is a heavyweight in its field, and the pounds are nearly equally distributed on all four wheels for greater stability.

Then in the suspension system itself: Famous Unitized Knee-Action, exclusive with Chevrolet in its field. A front ride stabilizer that reacts against any body roll tendency. Long, resilient rear springs that, leaf by leaf, diminish road vibrations. Tension type shackle hangers that regulate rear spring deflection rate and provide for a uniform ride regardless of the number of passengers. And, double-acting airplane type shock absorbers that not only cushion spring action but stabilize roll and body sway as well. See your Chevrolet dealer and try out a new Chevrolet. See if *Balanced Suspension* doesn't give you a much smoother ride. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

EVER FINER ENGINEERING CHEVROLET EVER FINER CHEVROLETS

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POPULAR SCIENCE
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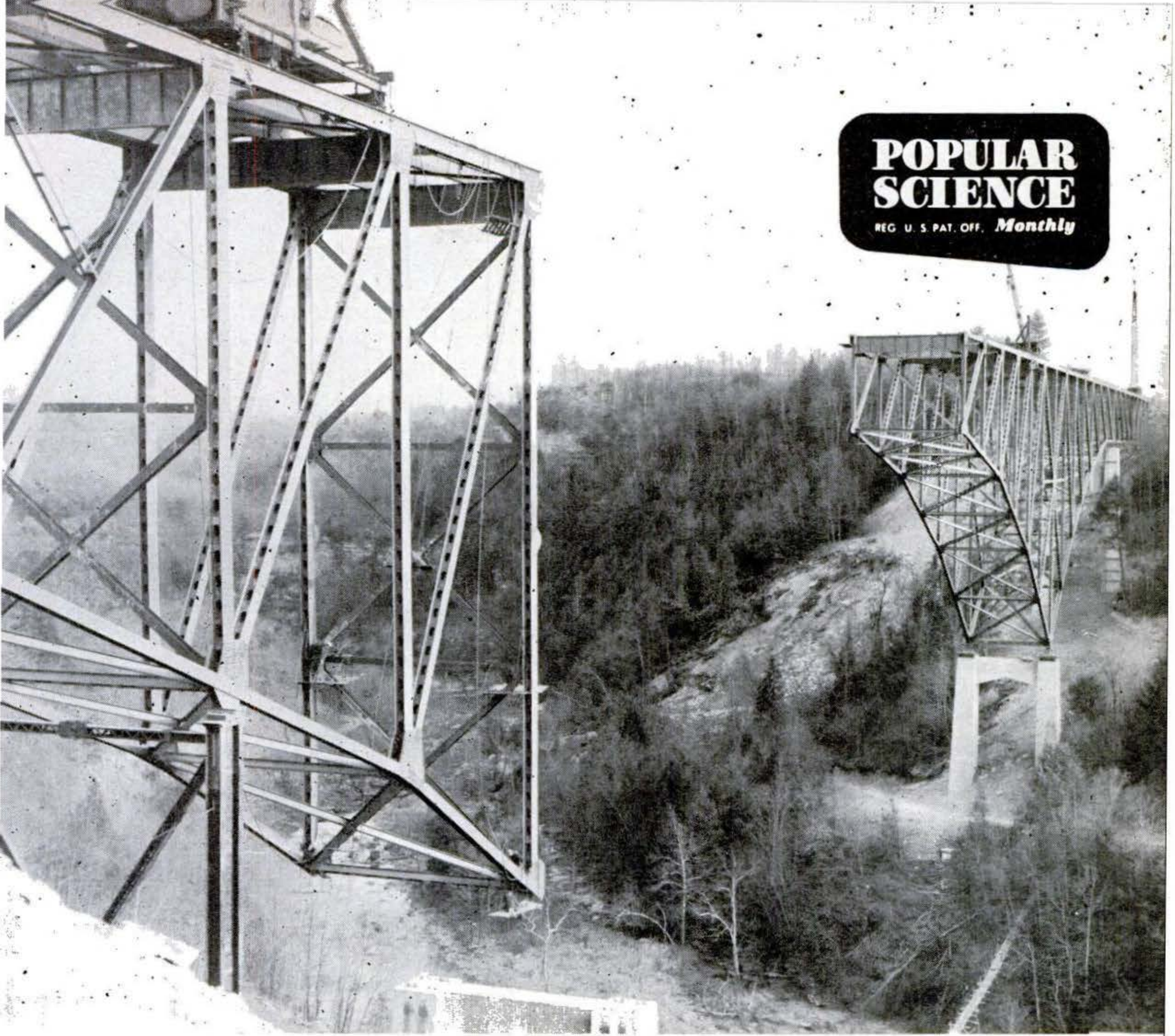

Steelwork for the two-lane expressway reaches across a deep ravine near Princeton, W. Va.

Newest Super-Road Hops Daniel Boone's Mountains

Vaulting over rugged valleys, West Virginia's highway in the sky, open this month, crosses 76 bridges in 87 scenic miles.

By George H. Waltz Jr.

A SUPERHIGHWAY that engineers and traffic experts are calling "the most spectacular road in America" opens its tollgates to the public this month. This new road is the West Virginia Turnpike—a hill-hopping heavy-duty highway that stabs through rugged mountains where no good roads, and no continuous railroad line, had ever been built. The

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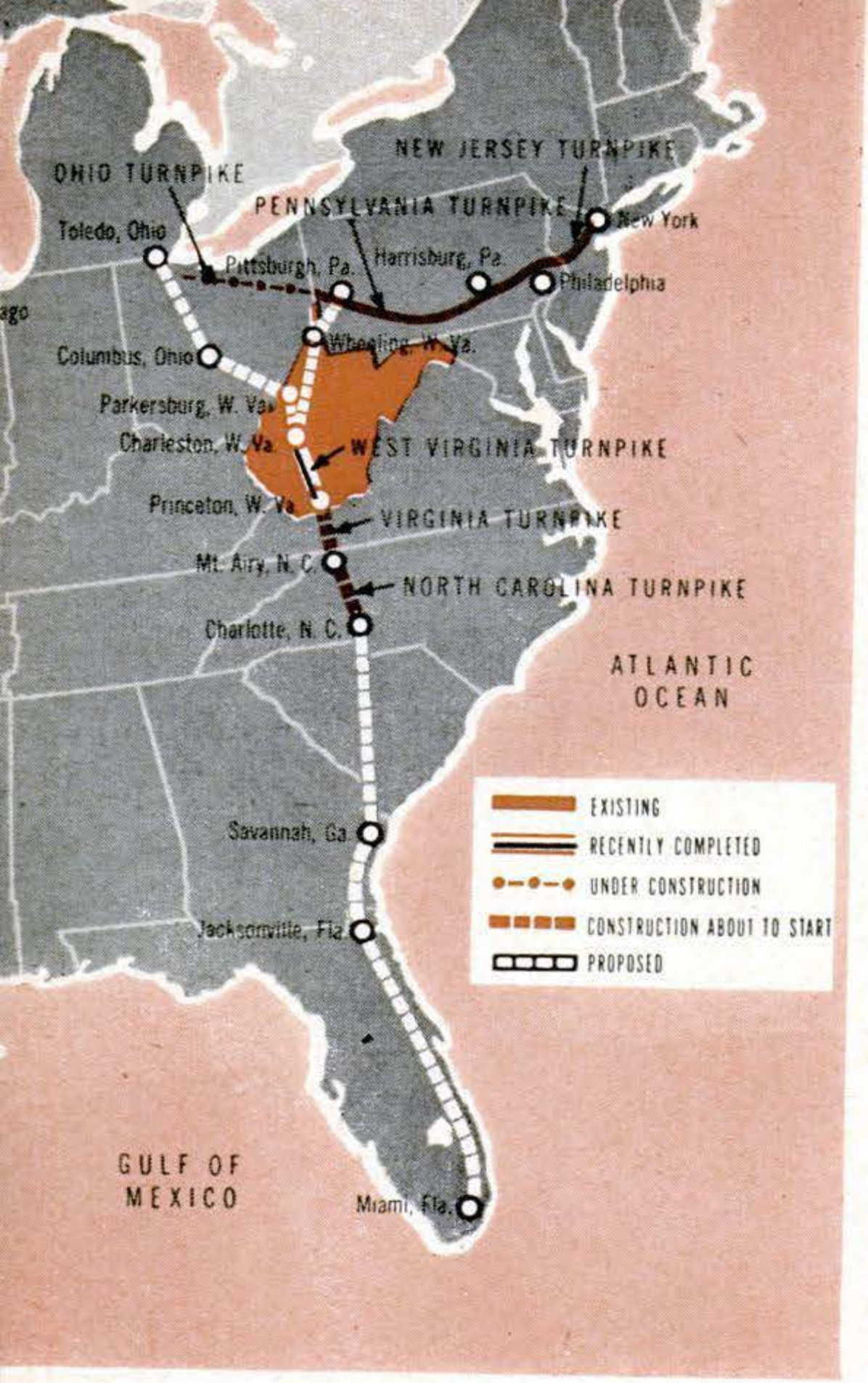

ROAD BUILDERS' DREAM of a north-south chain of express highways from the Great Lakes to southern Florida begins to come true with the opening this month of the West Virginia Turnpike. Map shows status of missing links and how new highway will connect with toll route now open, under construction or authorized from the East Coast to Chicago.

mile-a-minute super-road is the first completed link in a 1,300-mile Great Lakes-to-Florida chain of high-speed highways proposed by the traffic officials of West Virginia, Virginia and North Carolina. It cuts driving time between Charleston, West Virginia's capital, and Princeton, on the Virginia border, from nearly four hours to less than two.

An Up-and-Down Texas

Anyone who has ever driven *in* and *around* the mountains of southeastern West Virginia—and up until now that's all you could do—will never forget the almost virgin ruggedness of the country. As one of the new road's engineers put it when he first viewed the waves of hills that roll toward the south, "I'd bet that if West Virginia were flattened out, it would be twice the size of Texas!" And he was a Texan.

The new 87-mile high-speed highway does flatten out the mountains with deep cuts and leaps their valleys with bridges —76 of them, or almost one to a mile. In one six-mile stretch southeast of Charleston there are eight long spans and 20 high fills and embankments that bridge the valleys to smooth out the ridges. Few crows could now fly a straighter or more level course between Charleston and Princeton.

When you enter the road at Princeton, its southern end, you find yourself on a smooth two-lane concrete highway, each lane 12 feet wide and flanked by a nine-foot-wide macadam shoulder. Your elevation is 2,400 feet.

Steepest Grade Is Five Percent

Some 18 miles farther north you find yourself on Flat Top Mountain, elevation 3,200 feet, the highest point on the road. From there your descent is gradual, until you finally drive into bustling, industrial Charleston. Here the elevation is only 600 feet.

In spite of this half-mile difference between the road's loftiest and lowest points, you never hit any hill that climbs more than five feet in every 100 feet (road builders call that a five-percent grade).

Most of the grades along the route don't exceed three percent—no hill at all compared to the region's old roller-coaster roads with nine-percent grades that almost stop a truck.

Besides leveling off the hills, the new turnpike has also ironed out the curves. Tight and blind 50-foot-radius curves are about par for the old, roundabout Charleston-to-Princeton route. On the new highway, you never ease into any curve with a radius of less than 1,000 feet and you can always see at least 600 feet ahead.

As you drive along, you see views of mountains and valleys that no motorist has ever seen until now. The older roads snake around the mountains, with intervening peaks cutting off the view. Roll-

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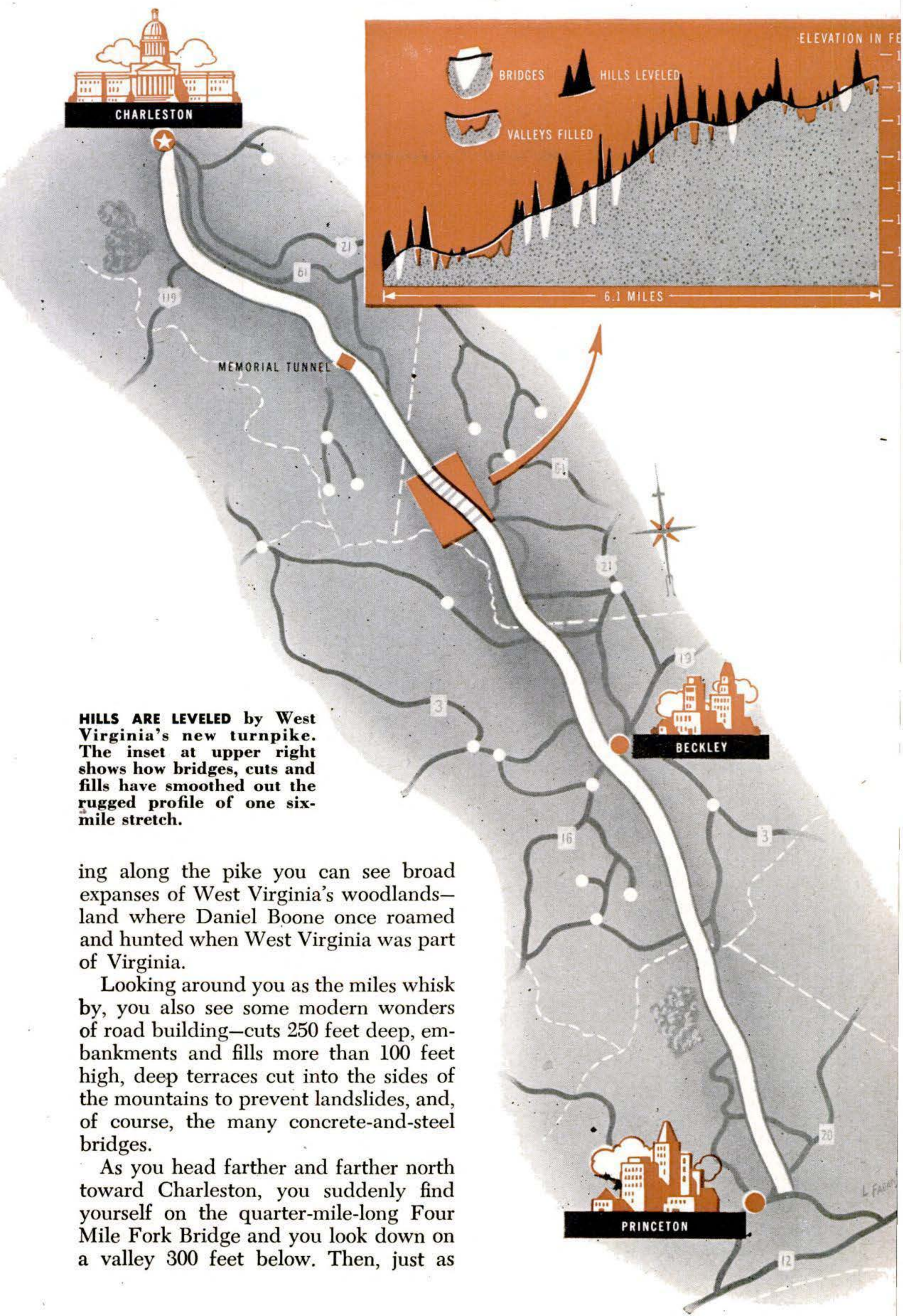

HILLS ARE LEVELED by West Virginia's new turnpike. The inset at upper right shows how bridges, cuts and fills have smoothed out the rugged profile of one six-mile stretch.

ing along the pike you can see broad expanses of West Virginia's woodlands—land where Daniel Boone once roamed and hunted when West Virginia was part of Virginia.

Looking around you as the miles whisk by, you also see some modern wonders of road building—cuts 250 feet deep, embankments and fills more than 100 feet high, deep terraces cut into the sides of the mountains to prevent landslides, and, of course, the many concrete-and-steel bridges.

As you head farther and farther north toward Charleston, you suddenly find yourself on the quarter-mile-long Four Mile Fork Bridge and you look down on a valley 300 feet below. Then, just as

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Bulldozers level a deep cut blasted through shale and sandstone for West Virginia pike.

suddenly, you plunge into the half-mile-long Memorial Tunnel, which bores through rock 600 feet below a mountain top.

During the course of your drive over the pike you see another highway innovation. In the spots where there are sustained upgrades (even though none exceed five percent), 12-foot-wide "creeper lanes" have been provided for trucks. These allow heavily laden cargo carriers to pull off to the right where they won't slow down the normal flow of faster-moving passenger cars.

Plans Call for Future Widening

Eventually, when traffic warrants it, the road will be widened to four lanes throughout most of the route. Four lanes are already provided at the road's six interchanges, and the necessary grading for an additional 30 miles of dualization has been completed.

Close to 12,000,000 pounds of dynamite were needed to blast out the deep cuts and to provide fill for the many embankments. In the year and a half of work, the road's builders—under the supervision of Howard, Needles, Tammen and Bergendoff, the engineers who also masterminded the construction of the Maine and New Jersey Turnpikes—excavated and moved more than 31,000,000 cubic yards of dirt and rocks. That's enough rubble to fill 2,000,000 big earth-moving trucks.

Fifteen miles of streams and creeks had to be diverted and about 35 miles of existing roads had to be relocated to make room for the new highway.

Yet, when all the tabs are in, the cost of the present two-lane, wide-shoulder road isn't expected to total more than $1,300,000 a mile. That compares favorably with the $2,000,000 a mile, four-lane New Jersey Turnpike that was constructed on relatively flat land. The toll, about 1.8 cents a mile for a passenger

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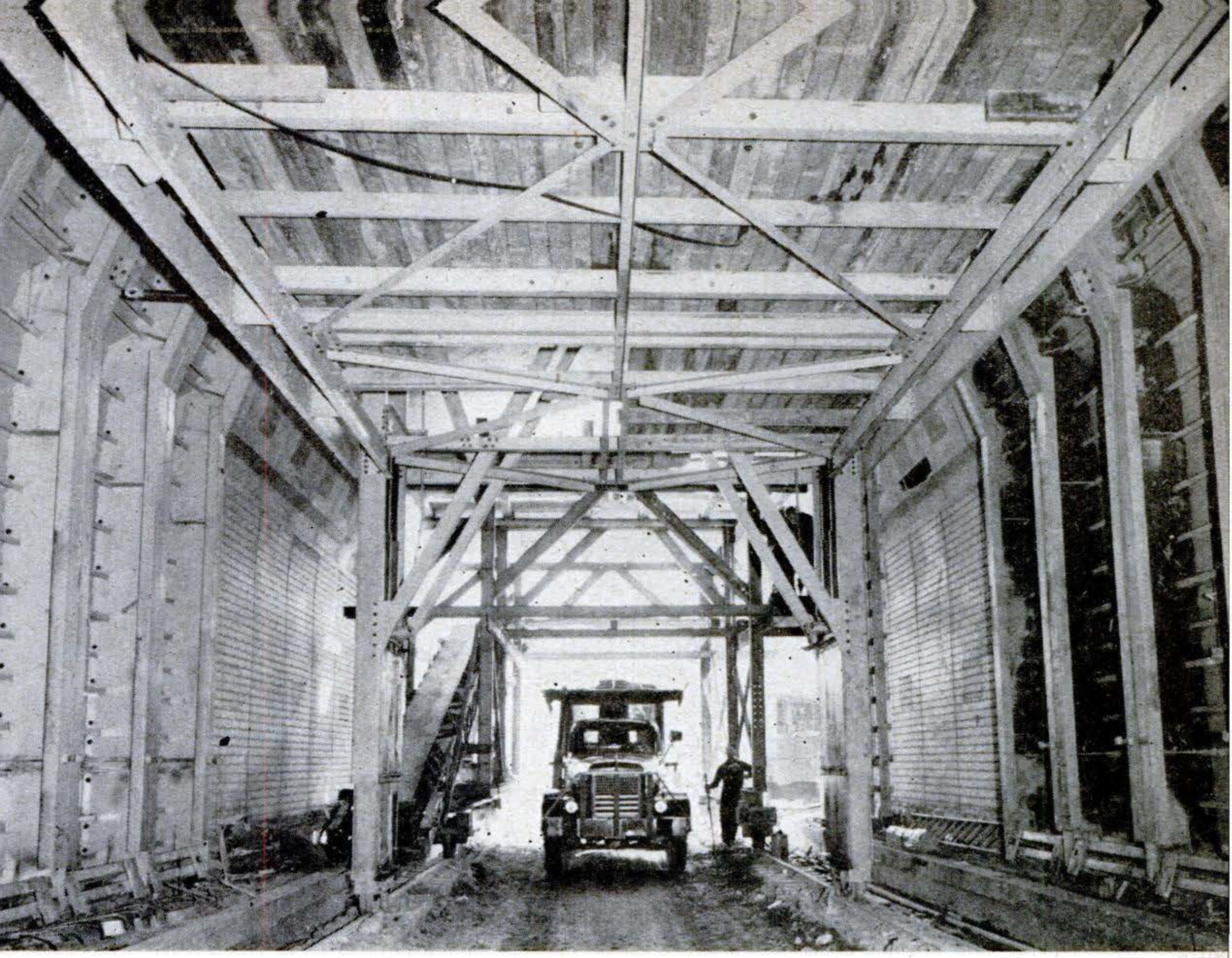

Form on rails speeds pouring of concrete walls of half-mile tunnel through a mountain.

car, is in line with those of other high-speed roads.

With this first link—and the most difficult one to build—in the projected north-south road chain now open, construction on two adjoining links is expected to get under way. Virginia is about to start on a sister turnpike that will cut across the southwestern corner of the state, joining up with the southern end of the West Virginia pike and extending to the vicinity of Mt. Airy, North Carolina. There it will link up with the projected North Carolina Turnpike that eventually will take the tourist through to Charlotte near the South Carolina border.

Plans for similar connecting high-speed roads in South Carolina, Georgia and Florida are under consideration. Plans are also afoot to extend the West Virginia Turnpike northward with two spurs, one to Parkersburg on the Ohio border and the other to Wheeling, to provide connections with the existing Pennsylvania Turnpike and the under-construction Ohio Turnpike.

In the meantime, however, the completed West Virginia Turnpike will help to bring the motorists in the north-central section of the country closer to the vacation lands of the South, and to bring the products of the South closer to the industrial areas of Detroit, Cleveland and Pittsburgh.

During the first year, turnpike officials calculate that more than 2,133,000 drivers will use the highway. In 1958, they expect the total to be over 3,000,000. END

HINT TO AN UNHANDY HANDY MAN

I found a loose joint in the gas line
Producing a bothersome hiss.
To make it up tight, I flipped on the light
And came out of the flip like this!

—Hugh Lineback

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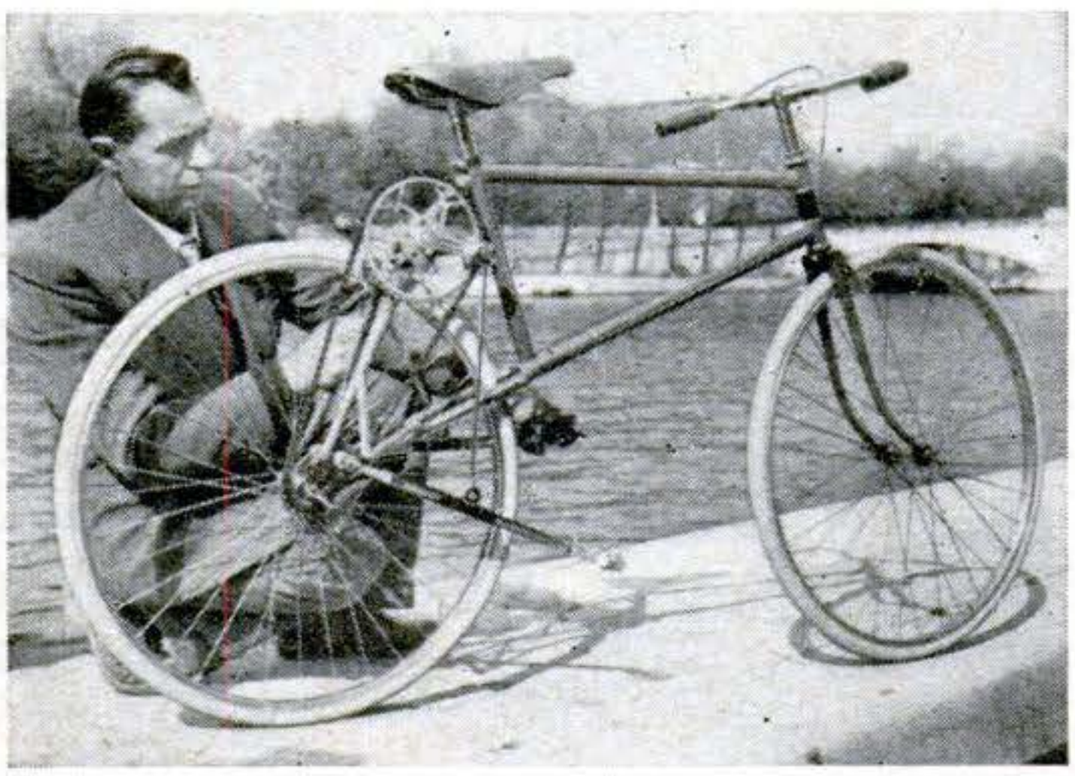
Sandhogs Go Way Down Deep to Help Build Chicago Skyscraper

THE workman above is riding a bucket down a caisson sunk to bedrock 102 feet under a Chicago street. Filled with concrete, the shaft will support a load-bearing girder of the 41-story Prudential Building, now going up two blocks from Lake Michigan.



Bike Pedals Pump Up and Down

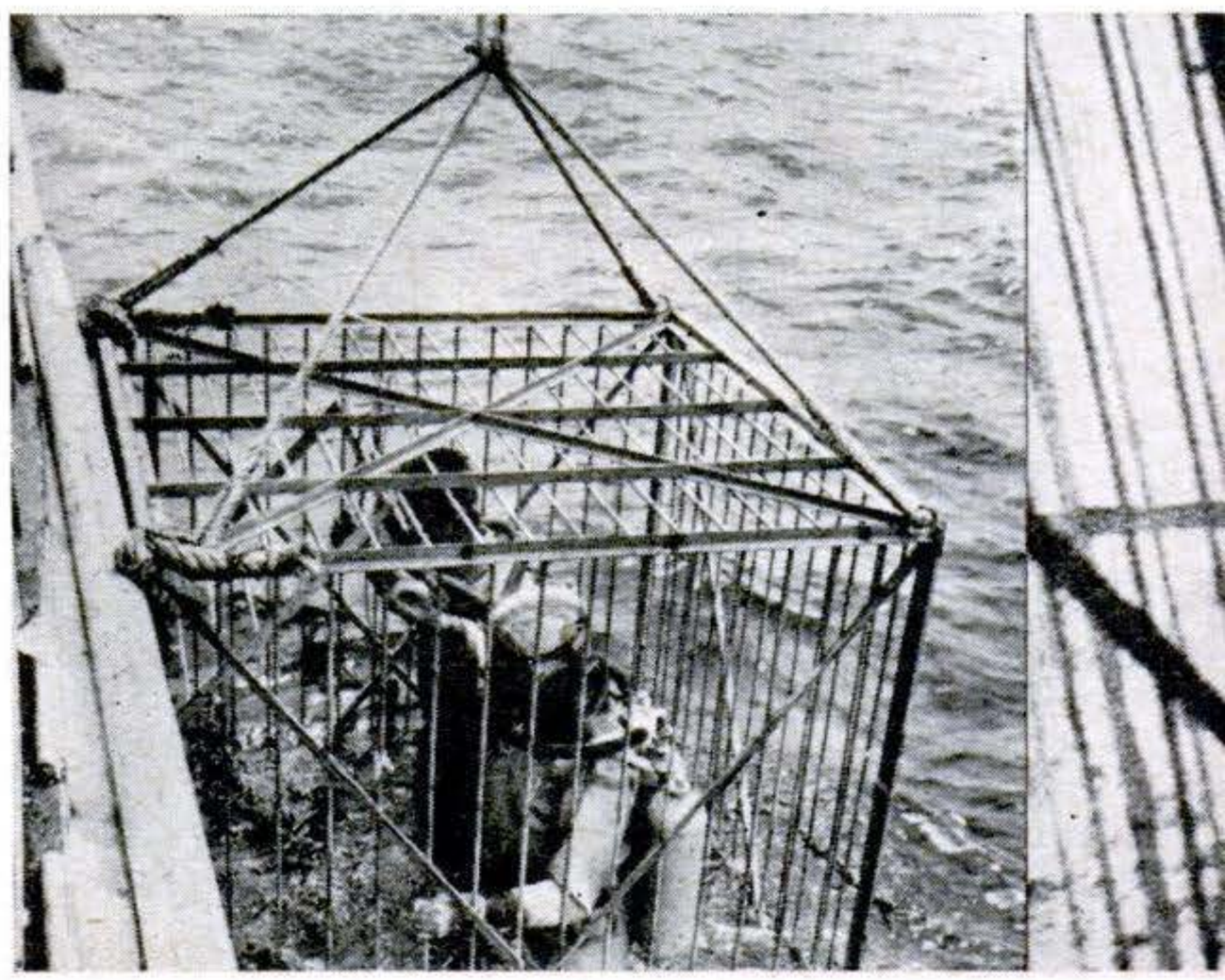
JOSEPH BENOTTEAU, a French inventor, figured you waste a lot of energy propelling a bicycle by pushing the pedals around in a full circle. He altered the bike as shown at left, and now an up-and-down pumping motion keeps it moving.

▶▶▶Helicopters now blow raindrops off ripe cherries so that the fruit won't split and be ruined by the water. The violent downblast of the rotors does the job.

Skin Divers Seek Undersea Oil

SKIN divers are going down as deep as 250 feet in the Persian Gulf to look for oil deposits. Led by Comdr. J. Y. Cousteau, famous French underwater explorer, a team of divers brings up rock samples for geologists of the Anglo-Iranian Oil Co.

A diver descends to the floor of the gulf in a sharkproof cage (right). He quits the safety of the metal bars to chip rock from the sea bed (center photo) and returns to the cage to deposit specimens (far right) or to make the ascent. But the cage is always nearby for a strategic retreat from snapping jaws, in case a man-eater puts in an appearance.



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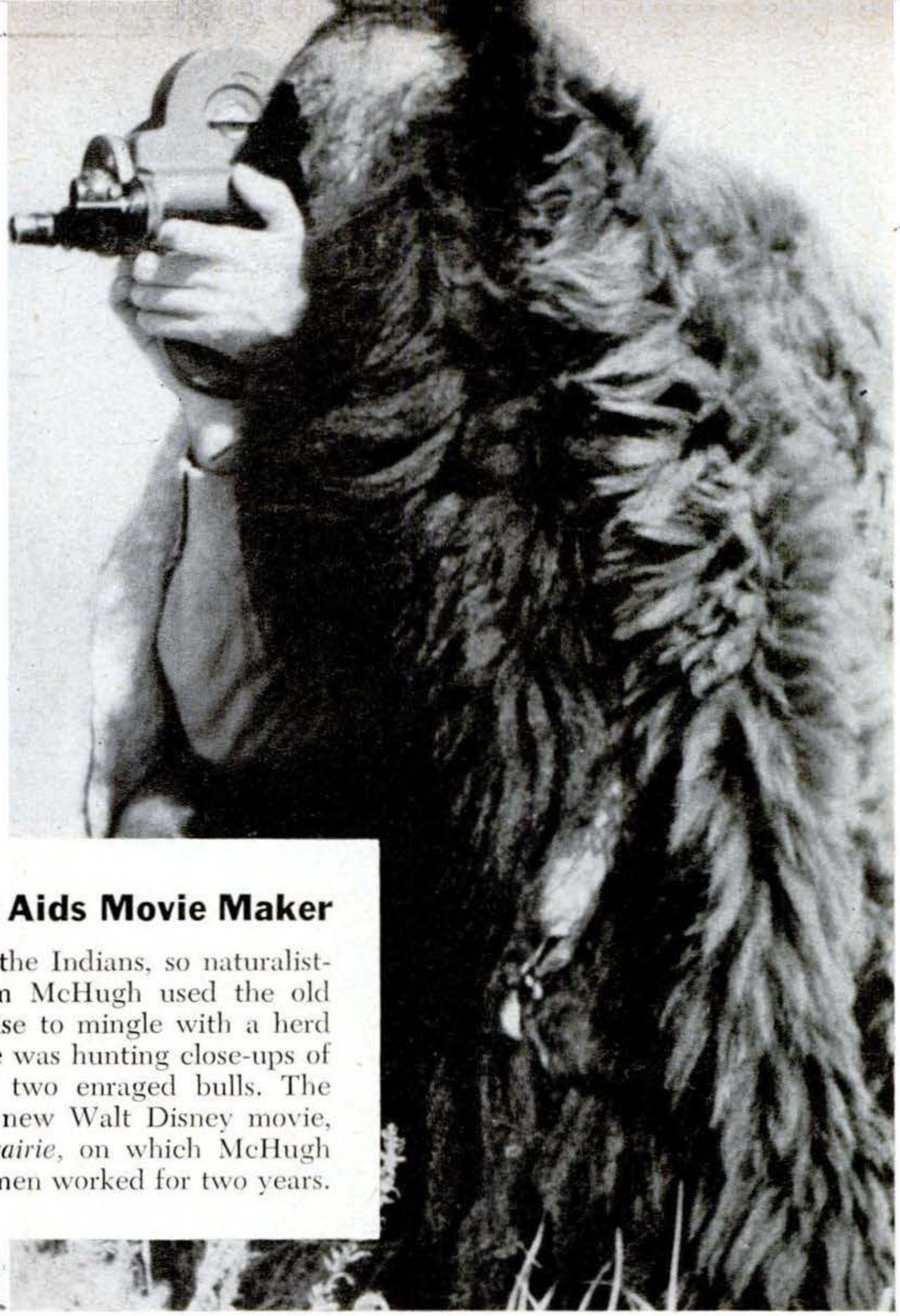
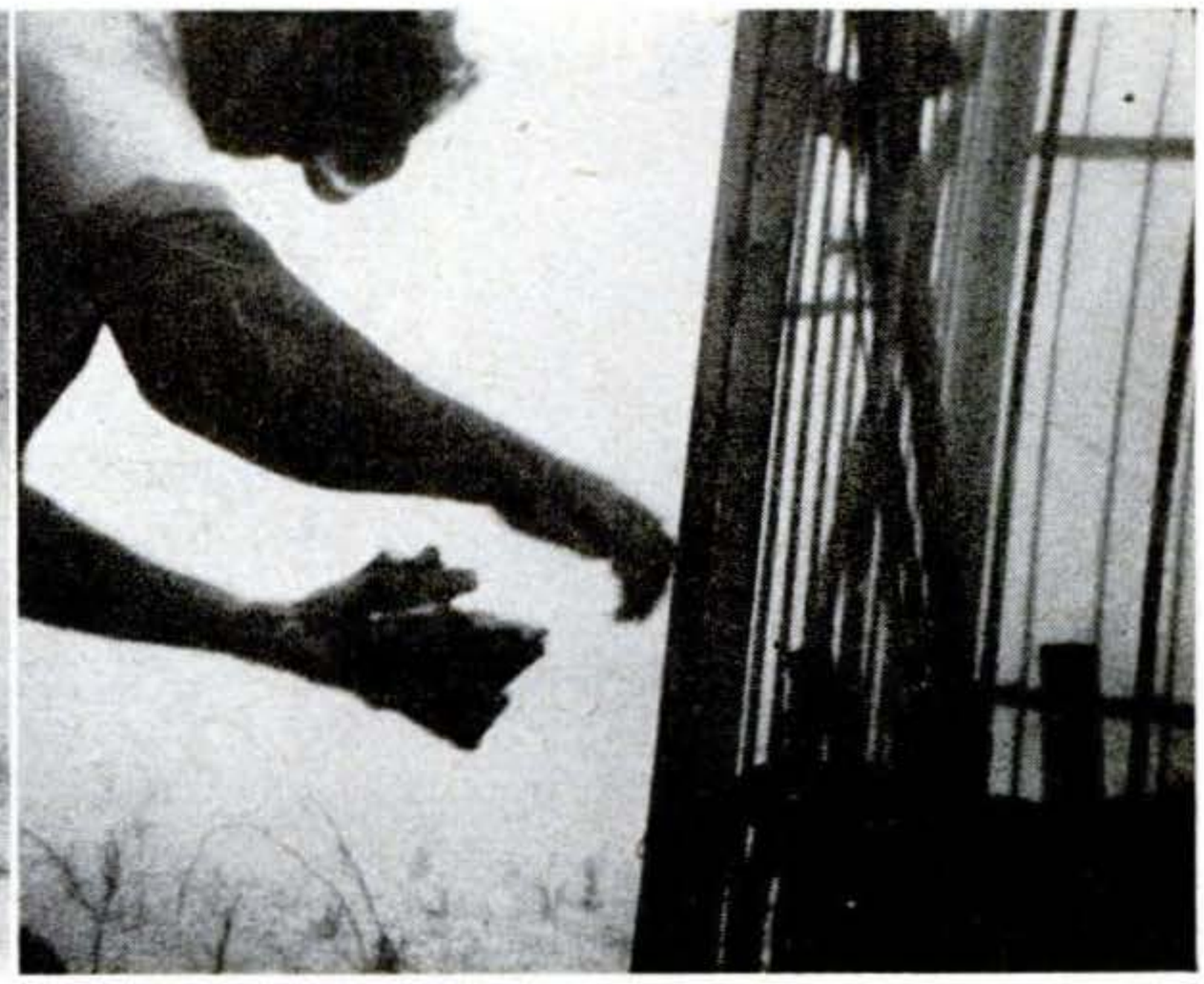


Indian Trick Aids Movie Maker

IT WORKED for the Indians, so naturalist-photographer Tom McHugh used the old buffalo-skin disguise to mingle with a herd of the animals. He was hunting close-ups of a battle between two enraged bulls. The fight is part of a new Walt Disney movie, *The Vanishing Prairie*, on which McHugh and other cameramen worked for two years.



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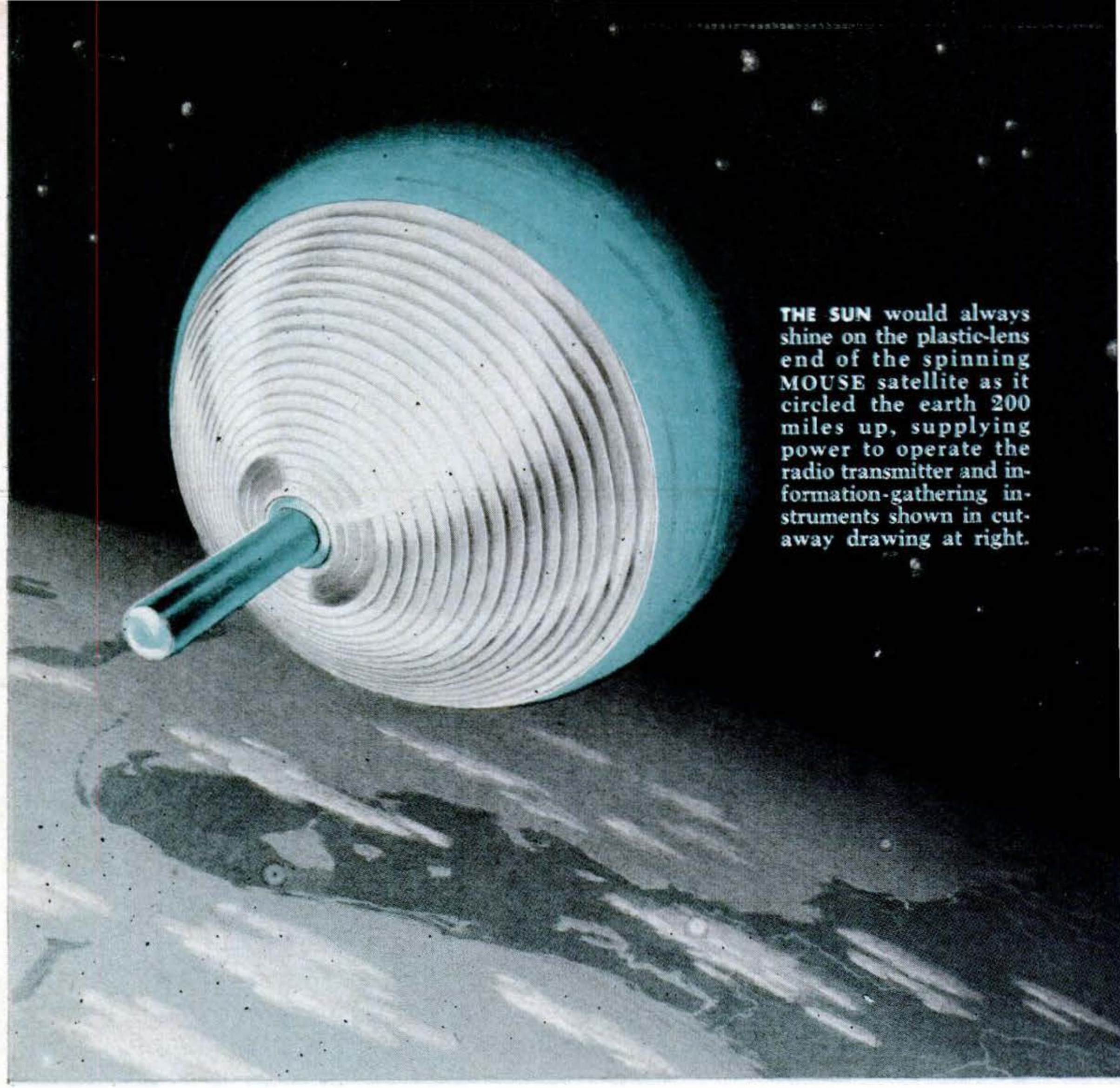

THE SUN would always shine on the plastic-lens end of the spinning MOUSE satellite as it circled the earth 200 miles up, supplying power to operate the radio transmitter and information-gathering instruments shown in cutaway drawing at right.

Scientist wants to shoot up midget moon as

Poor Man's Space Station

Spinning high above the earth, this MOUSE satellite would explore solar mysteries hidden from us by the atmosphere.

By Herbert O. Johansen

FOR a space station that would circle the earth as an artificial moon, the MOUSE is as modest as its name. It would be small enough to be built in your basement. It would have no ambitions for interplanetary flight, yet it would be able to probe far enough into space to study mysterious solar and

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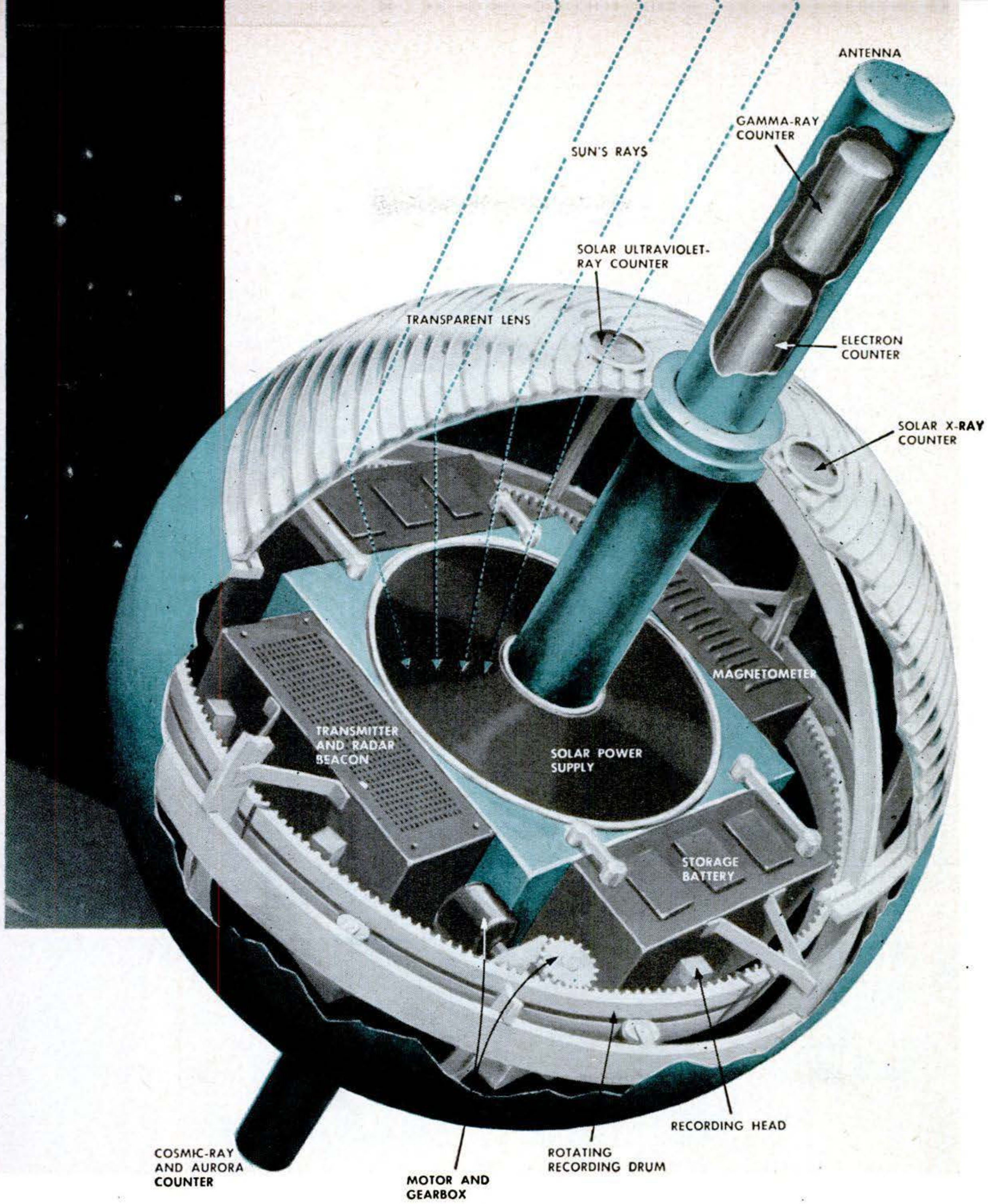

cosmic radiations that now are hidden from us by the atmosphere.

The man who wants to build the MOUSE (Minimum Orbital Unmanned Satellite of the Earth) is a serious, 29-year-old physicist at the University of Maryland, Professor S. F. Singer.

Dr. Singer's midget moon would be no military stronghold or bombing platform in outer space. Its mission would be peaceful. Circling at about 200 miles above the earth, it would carry not even a live mouse or monkey. It would use instruments to make its studies of the upper atmosphere and report back by radio new clues as to how the sun's radi-

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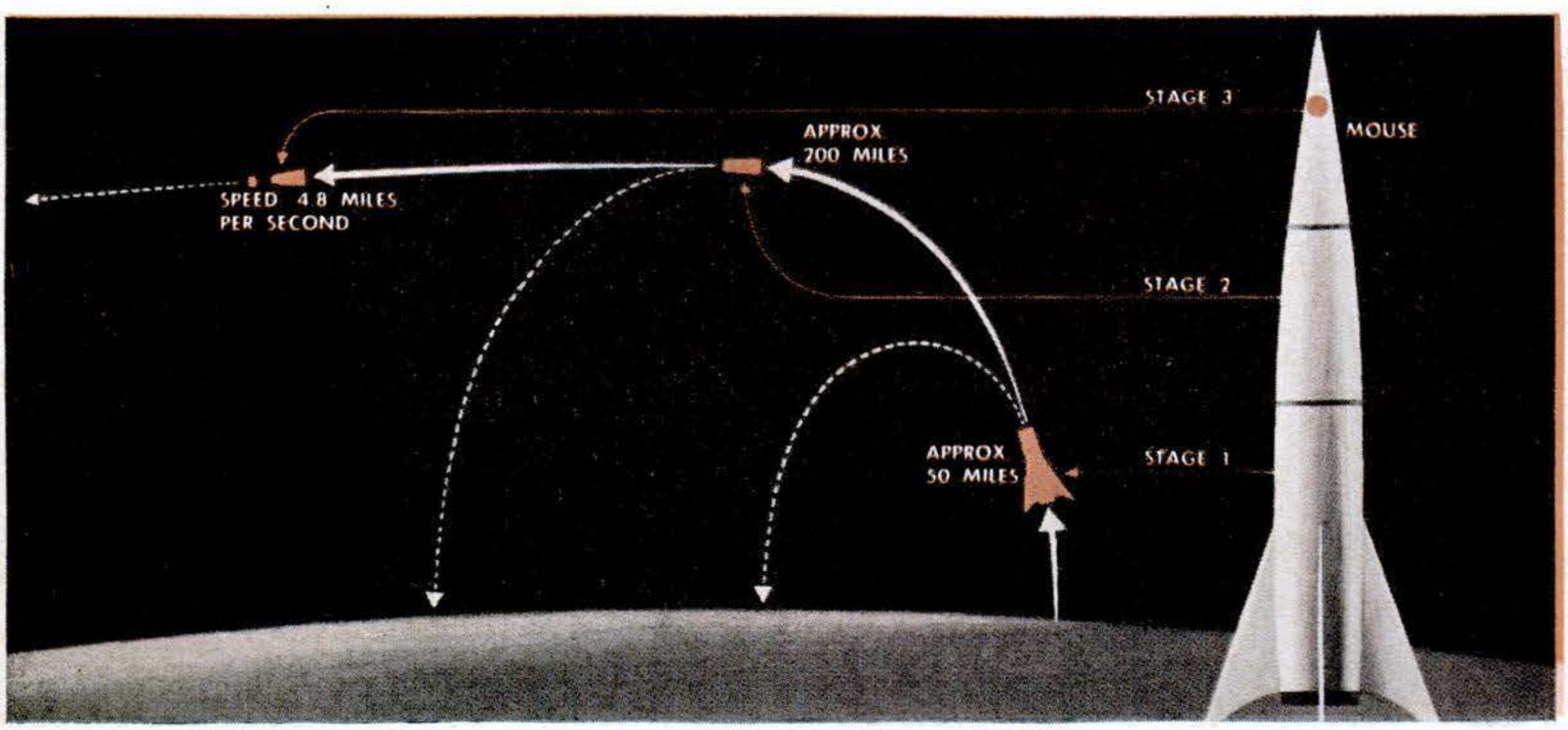
ations affect our everyday lives in the forms of magnetic storms, the ups-and-downs of long-range radio communications and weather.

What Dr. Singer has conceived for the job is a spinning, hollow aluminum sphere, about two feet in diameter and weighing 100 pounds or so. Most of the weight would consist of electrical-power equipment and the instruments for measuring cosmic rays, solar ultraviolet rays and X rays. The whole thing, he believes, could be put together for about $50,000. That wouldn't even buy standing room for a midget on one of those fancy, giant space platforms that would weigh many tons and carry a prohibitive price tag of around four billion dollars.

DR. S. F. SINGER, designer of MOUSE, is a veteran of high-altitude research and an expert on cosmic rays.

To get his MOUSE up there, Dr. Singer would use a three-stage rocket. This would bring the cost up to only about $1,000,000. That, he points out, is less than the cost of a single jet-fighter plane. He feels that existing military sounding rockets or models under development could do the job. At the recent Third Symposium on Space Travel, held at the Hayden Planetarium in The American Museum of Natural History in New York, he described the MOUSE as "a logical extension of the high-altitude research which we have been conducting in rockets over the past eight years."

For launching, Dr. Singer sees his MOUSE mounted and already spinning in a nose cap atop a pyramid of three rockets, with a modified V-2 as the springboard. As the V-2 was fired, the unit would leap straight up. Then, at about 50 miles up, it would start to curve slightly as the V-2 burned out and dropped off. Speed would be 7,200 miles an hour. As the second rocket took over, the truncated pyramid would gain speed and altitude. The curve would increase. At close to 200 miles up, as the second rocket burned out, speed would be 12,600 miles an hour, and direction almost horizontal.



HOW THE MOUSE ARTIFICIAL MOON would be launched. The small satellite sphere would be mounted in gimbals on top of a three-stage rocket. Before take-off, the MOUSE would be started spinning on its horizontal axis. Each stage of the rocket, as it fired, would boost the satellite to a higher altitude and greatly increase its velocity.

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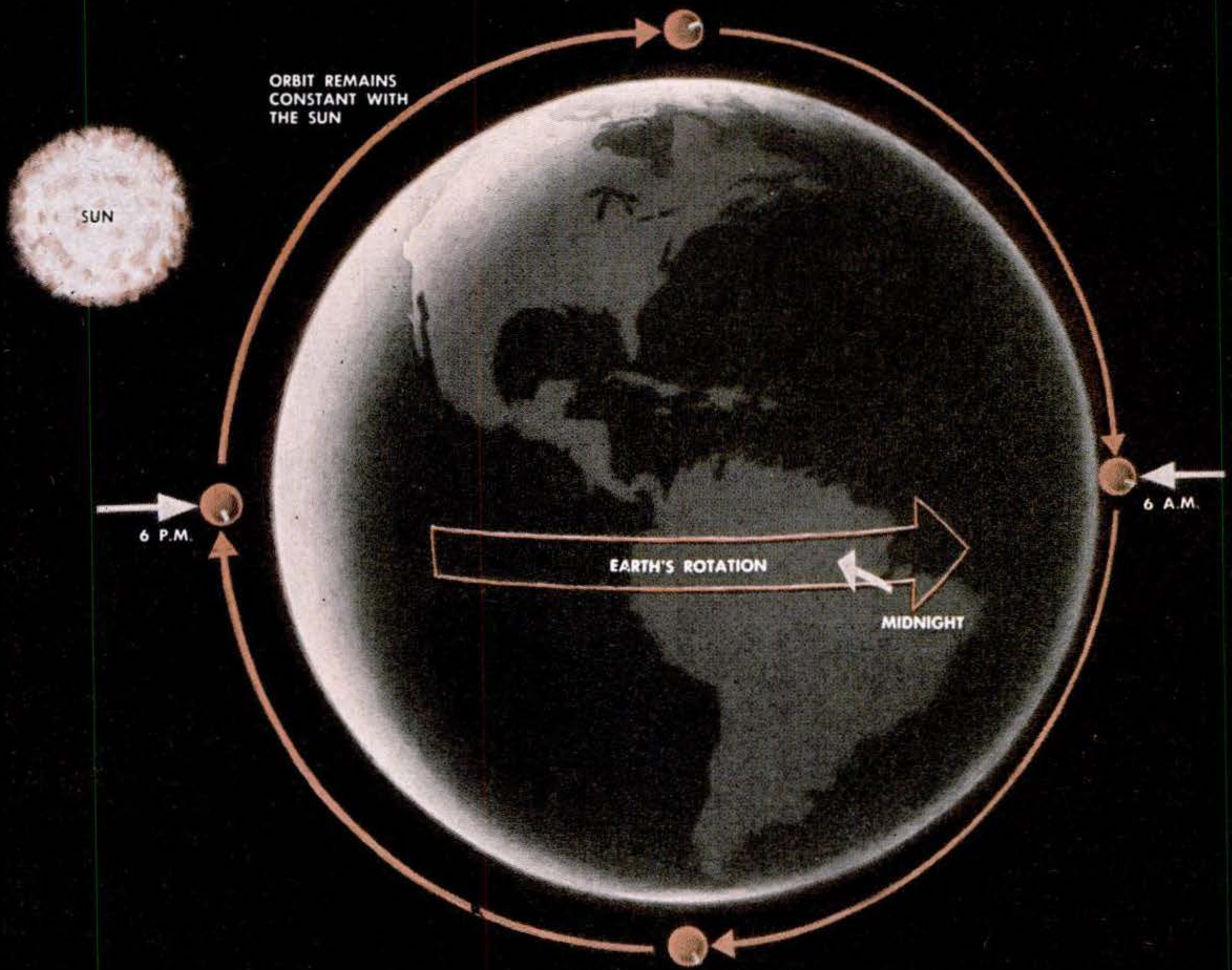

AS AN ARTIFICIAL MOON, the MOUSE would circle the earth over the North and South Poles once every 90 minutes. Since the orbit would be in a plane perpendicular to the sun-earth line, it would always appear overhead at either 6 a.m. or 6 p.m. local time. Spinning action of the MOUSE would keep same end of the satellite always facing sun.

Now the third rocket would fire for the final boost. Its job would be to kick the MOUSE up to its final altitude, a little more than 200 miles above the earth, and to its orbital velocity of 17,-280 miles an hour.

At that point, about five minutes after take-off, the MOUSE would be sprung from its bearings to continue on its own in an orbit forming a great circle, going over the North and South Poles once every 90 minutes. And the burned-out third rocket would come tumbling after, itself a satellite.

The MOUSE, now an artificial moon, would have to be stable in traveling its orbit. This would be taken care of by the spinning action started before take-off. It would continue to spin in its orbit, but if necessary, small vanes in the satellite's skin would enable even the thin air 200 miles up to maintain the spin.

Windows to Let in Sunlight

This spinning not only would stabilize the MOUSE in its orbit, but because the orbit is over the poles instead of following the equator, the same end always would be facing the sun. Thus this end, in the form of a plastic lens, would admit the maximum of sunlight to activate a

[Continued on page 222]

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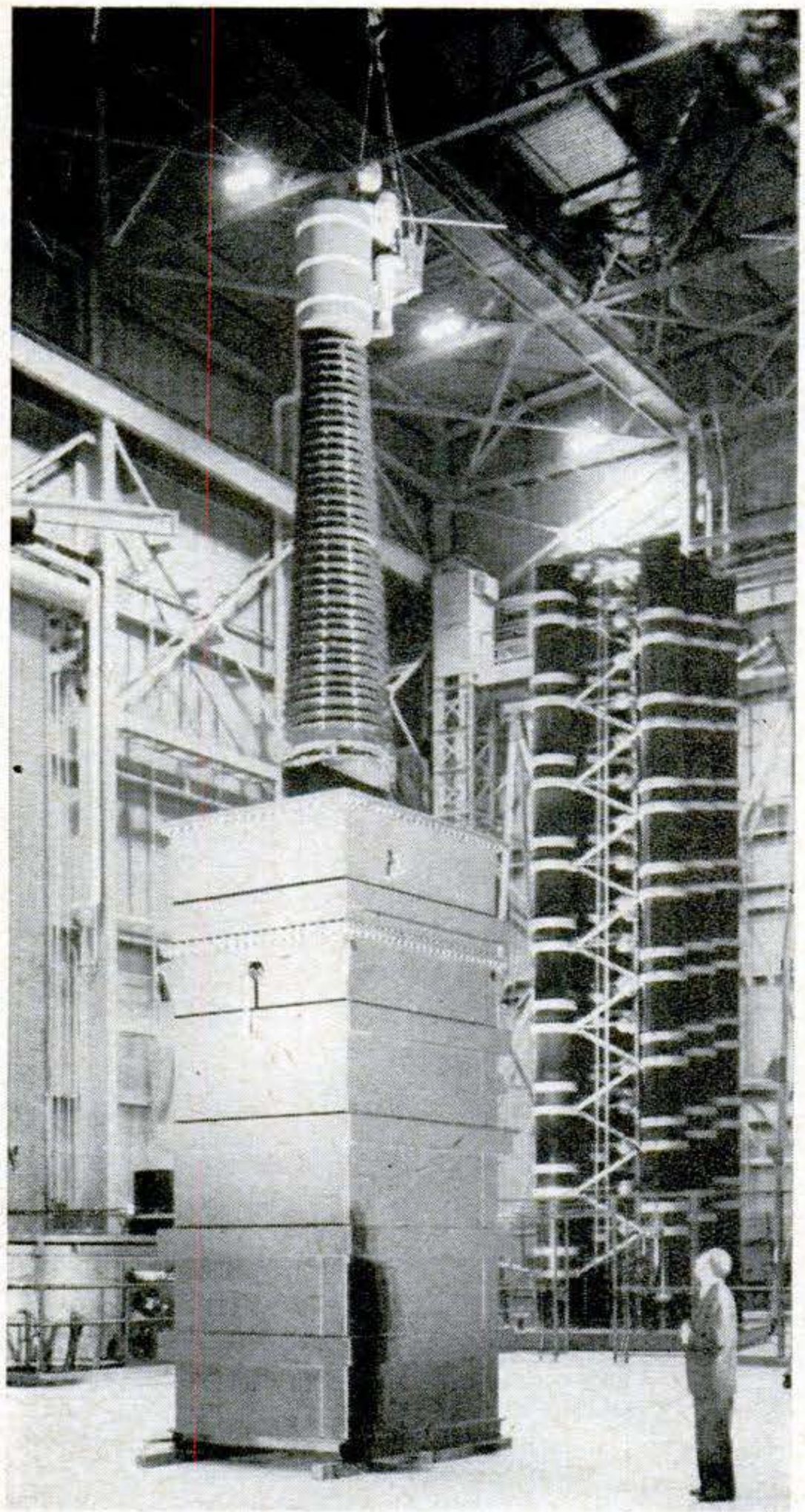
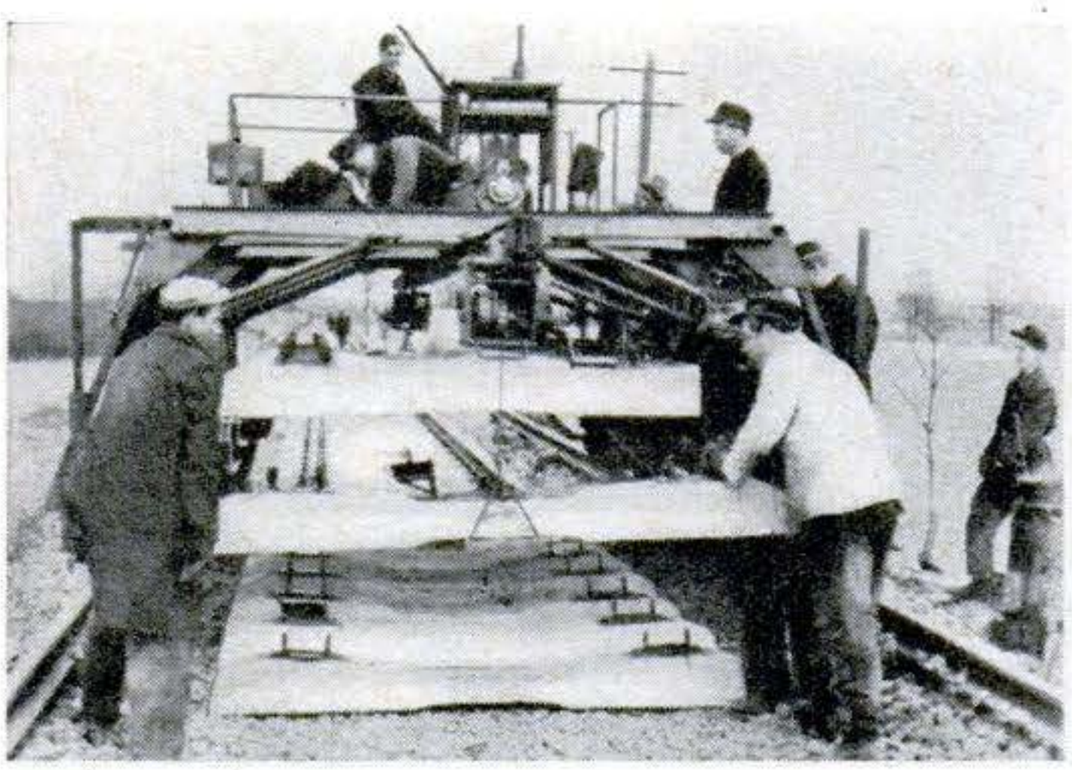


Inspector Gets Bird's-Eye View

THE engineer—way up there—had to ride a bosun's chair to inspect this transformer, largest of its type. A three-story, 50,000-pound monster, it has 50 miles of wire and a ton and a half of insulation. General Electric will use it to test circuit breakers.

Army Tries New Marsh Buggy

THE 22½-foot marsh buggy above is reporting in to the Army for field tests. Six 10-foot tires wheel it through sand and muck, or up steep banks. With rubber-cleat chains added, the Gulf Oil vehicle takes to water like a paddle-wheel steamer.



Machine Rides Track It Lays

THIS mechanical track layer, humping itself along the very rails it later will lay on ties, is putting down almost a half-mile of track a day in Germany. Spanning the roadbed, it drops the rails—each 131 yards long—on ties as fast as these are put in position.

They Say Now .....

L. E. BRIGGS, FORD MOTOR CO.: *"If tomorrow's car is to travel twice as fast as today's, it must first be made twice as safe."*

FRANCIS K. MCCUNE, GENERAL MANAGER, GE ATOMIC PRODUCTS DIVISION: *"Electric utility companies will be owning and operating a number of atomic power plants within the next 10 years."*

WILLIAM H. WARD, VICE-PRESIDENT, THE DU PONT CO.: *"The number of new chemicals which can be produced is almost infinite and the research laboratories develop about 10,000 every year."*

MAJ. ALEXANDER P. DE SEVERSKY, PIONEER AIRPLANE DESIGNER: *"The electronic capabilities of a combat aircraft have become even more decisive than its firepower."*

EARL C. KUBICEK, ILLINOIS INSTITUTE OF TECHNOLOGY: *"It wasn't long ago that most companies would hire anyone who could handle the job. Now they are looking for applicants who show the greatest promise and who will stay with the company."*

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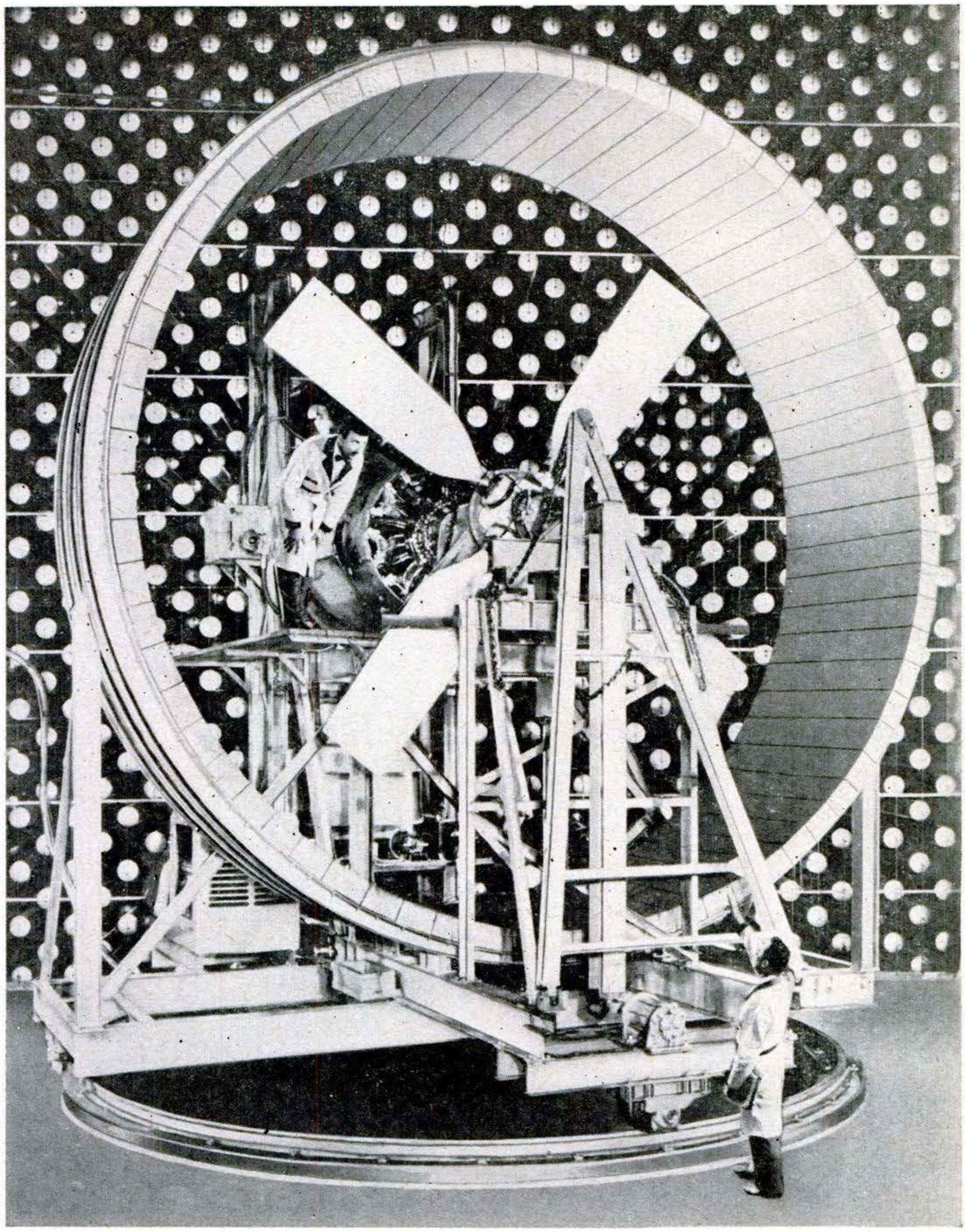

Giant Gyroscope Tests Turboprops

AGAINST a polka-dot background of sound-proofing, high-performance propellers get the works in this gyroscopic whirl-rig that simulates actual flight-testing. When a propeller is spinning at high speed, the whole rig, mounted on wheels, can turn on a 20-foot circular track to duplicate sideway in flight. For safety, a 21-foot-diameter, barrel-like guard rim is lined with railroad ties. Engineers at the Caldwell, N.J., plant of Curtiss-Wright, who designed the device, say that because of greater control, it is more efficient than testing new prop units in an airplane.

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LITTLE JET, named A4D Skyhawk, here carries extra fuel tank under fuselage. Presumption is that atom bomb would be mounted there. Two other extra tanks can attach to wings.

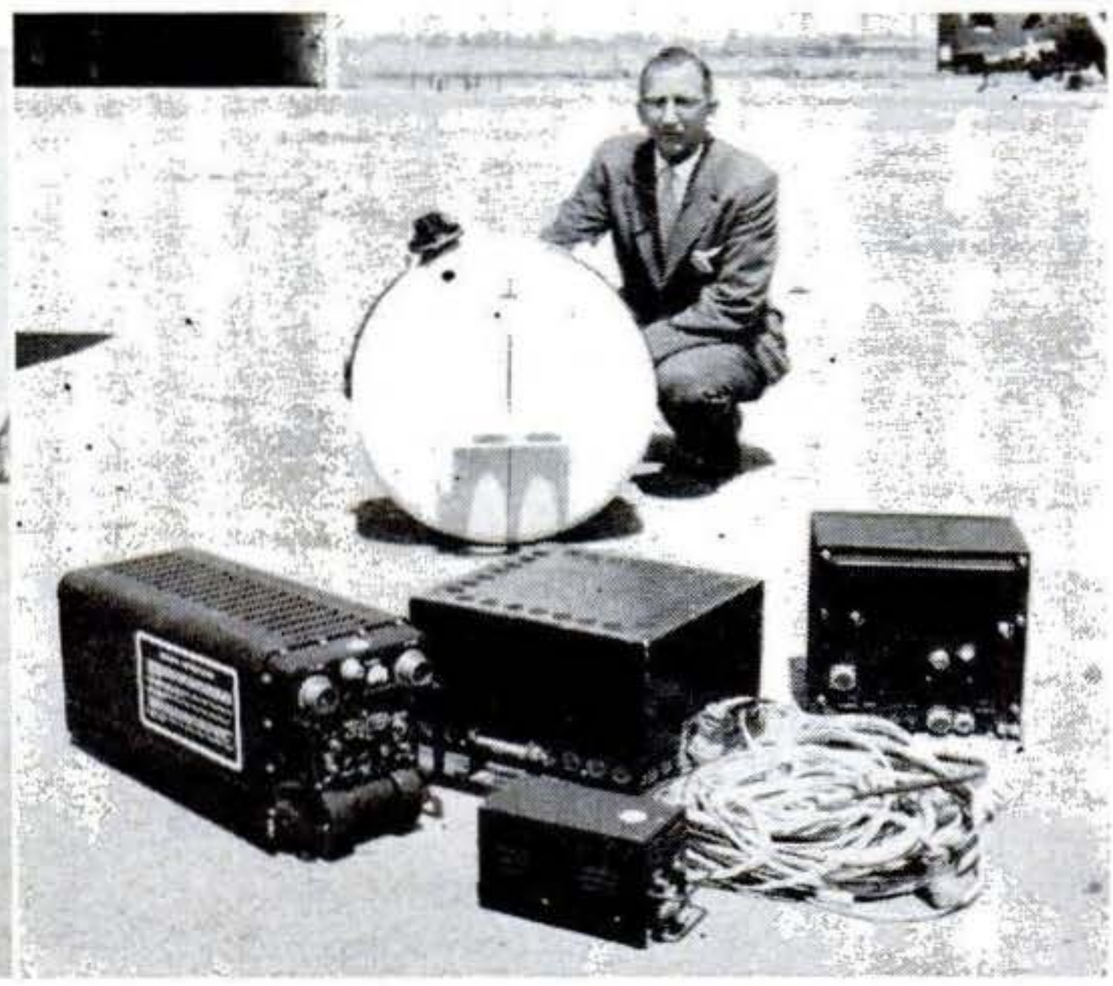
Bantam Jet Can Tote A-Bomb

A BANTAM bomber is being built for the U. S. Navy. It's smaller than most fighter planes. It may well be the smallest bomber in the world.

Yet it is built to carry an A-bomb. With extra fuel tanks, it can span the U. S. non-stop. At sea, operating from a carrier, it has a combat radius of 1,200 miles. It's fast. Douglas Aircraft, the builder, says it can outfly a Russian MIG.

Jet fighters weigh up to 40,000 pounds. The bantam bomber, which is powered by a single engine, tips the beam at less than 15,000 pounds.

BANTAM'S WEIGHT was cut by use of lighter components. Woman officer easily lifts 30-pound pilot-ejection seat (left), while two men wrestle with regulation 70-pound seat.



PACKAGE COMMUNICATIONS INSTALLATION, weighing 105 pounds, is held by Ed Heinemann, factory engineer. In foreground is standard equipment, totaling 160 pounds.

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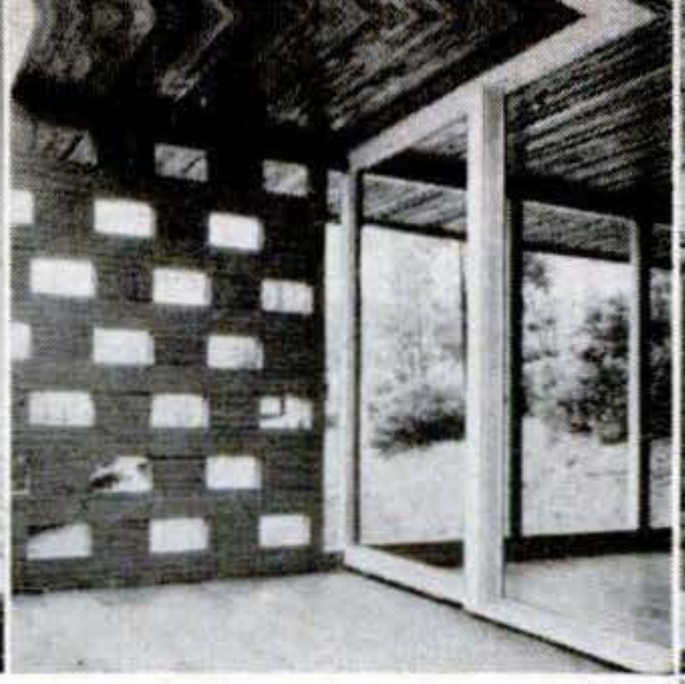
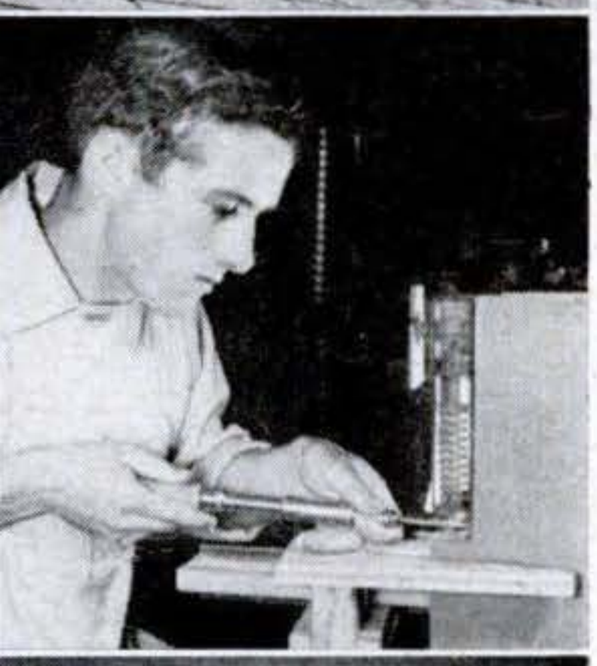
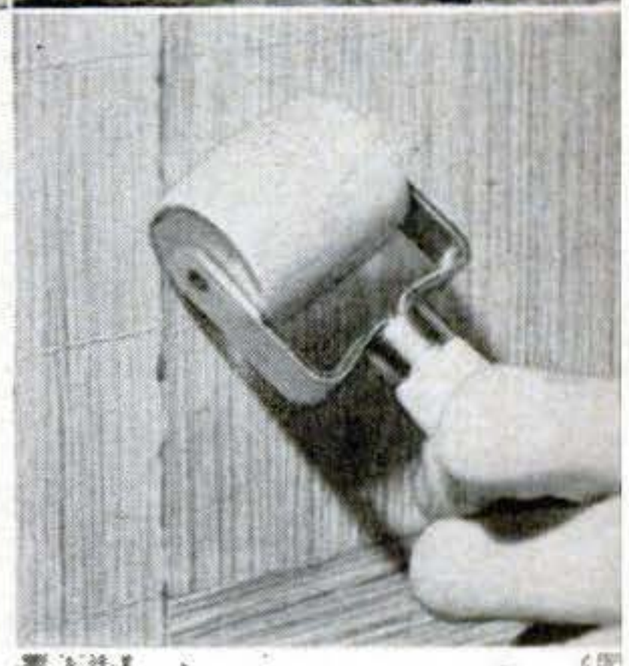


Next Month:

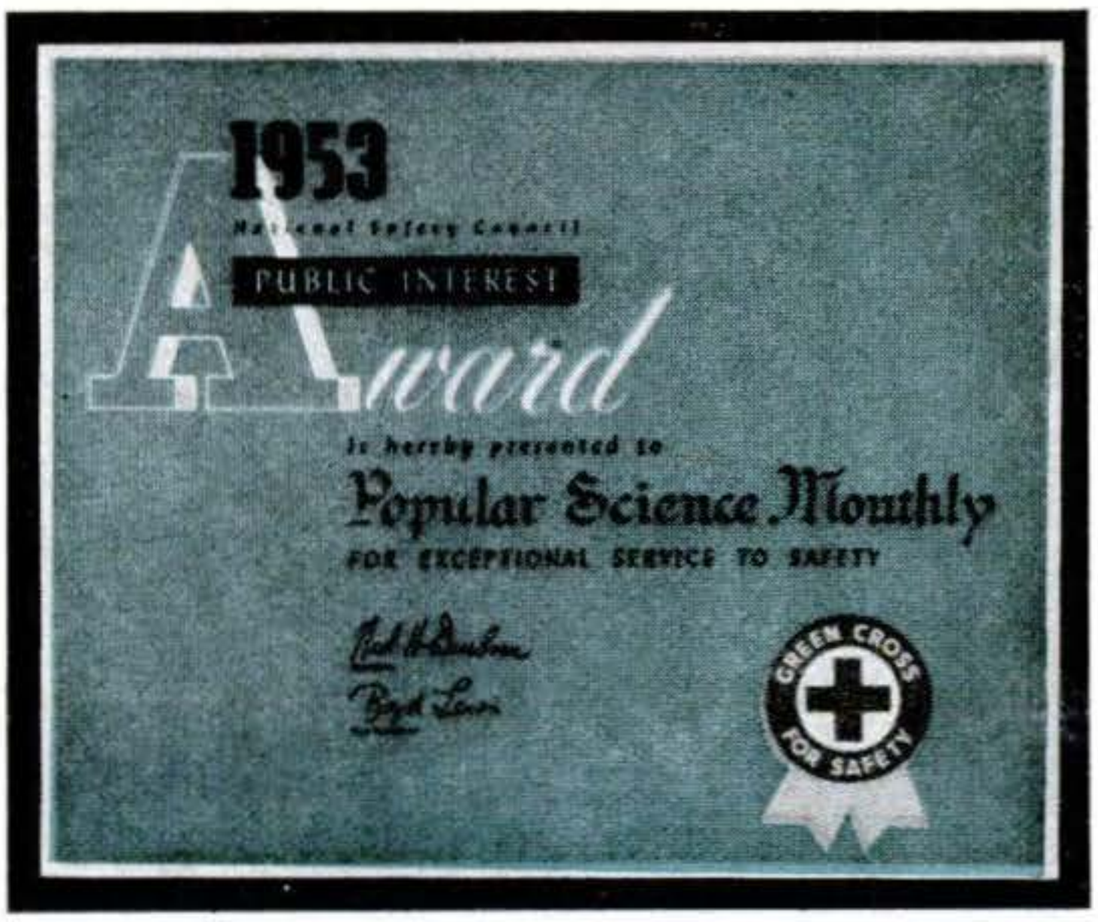
Special Section of Money-Saving Ideas For Your Home

The September issue of PSM will be packed with new ideas for every part of your house, from basement to attic. They'll save you money, add value to your home. Don't miss this bonus issue.

PSM Wins Safety Award Again

For the third consecutive year, Popular Science Monthly has been honored for exceptional service in the nationwide fight against accidents. PSM won a 1953 Public Interest Award, granted annually to information agencies by the National Safety Council. The citation is in the form of a wall plaque, pictured at right.

Accompanying the announcement of the award, which also went to 12 other national magazines, was praise for the winners from Ned H. Dearborn, council president: "Their initiative and skill are . . . really giving safety a voice that can be heard."



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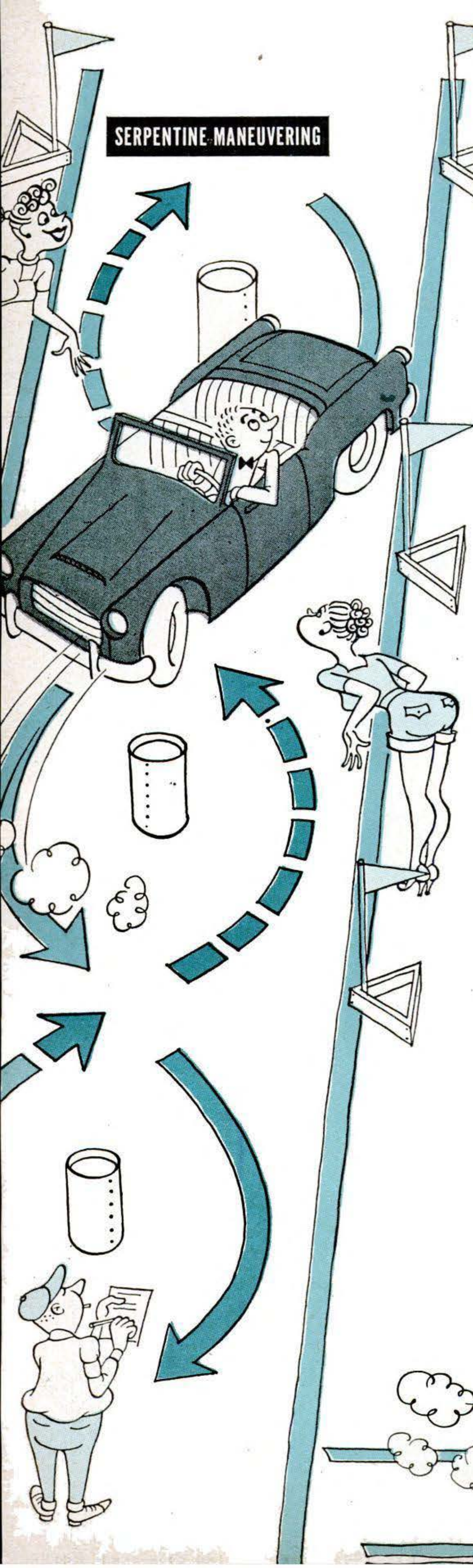
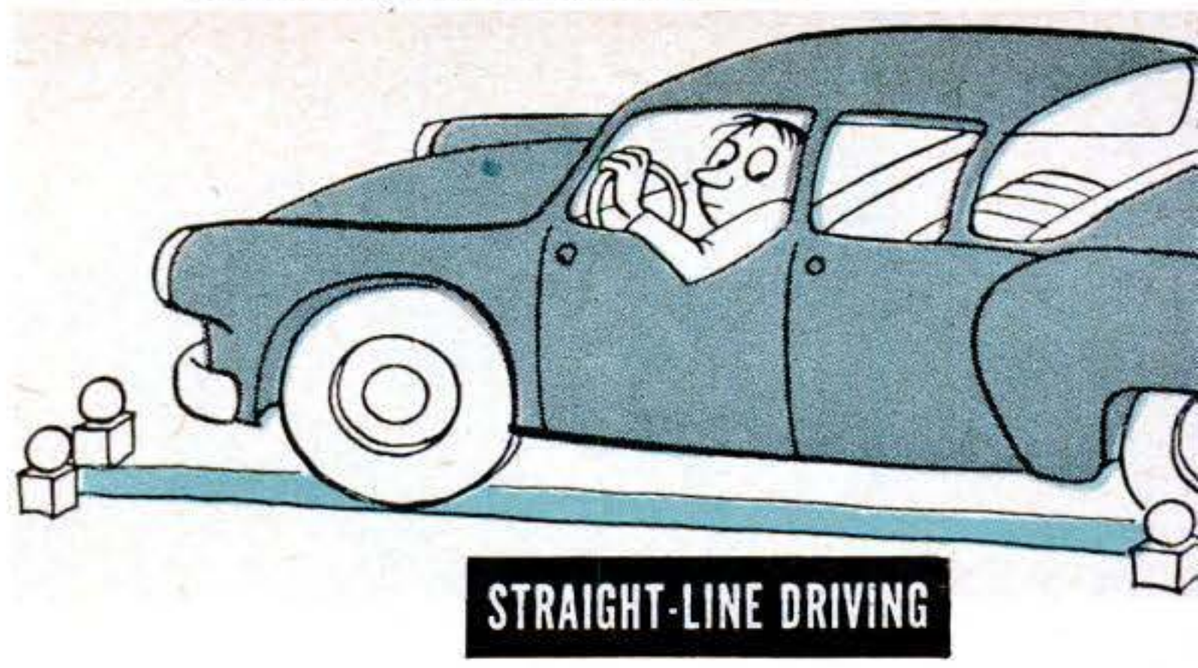




How they pick

America's Best

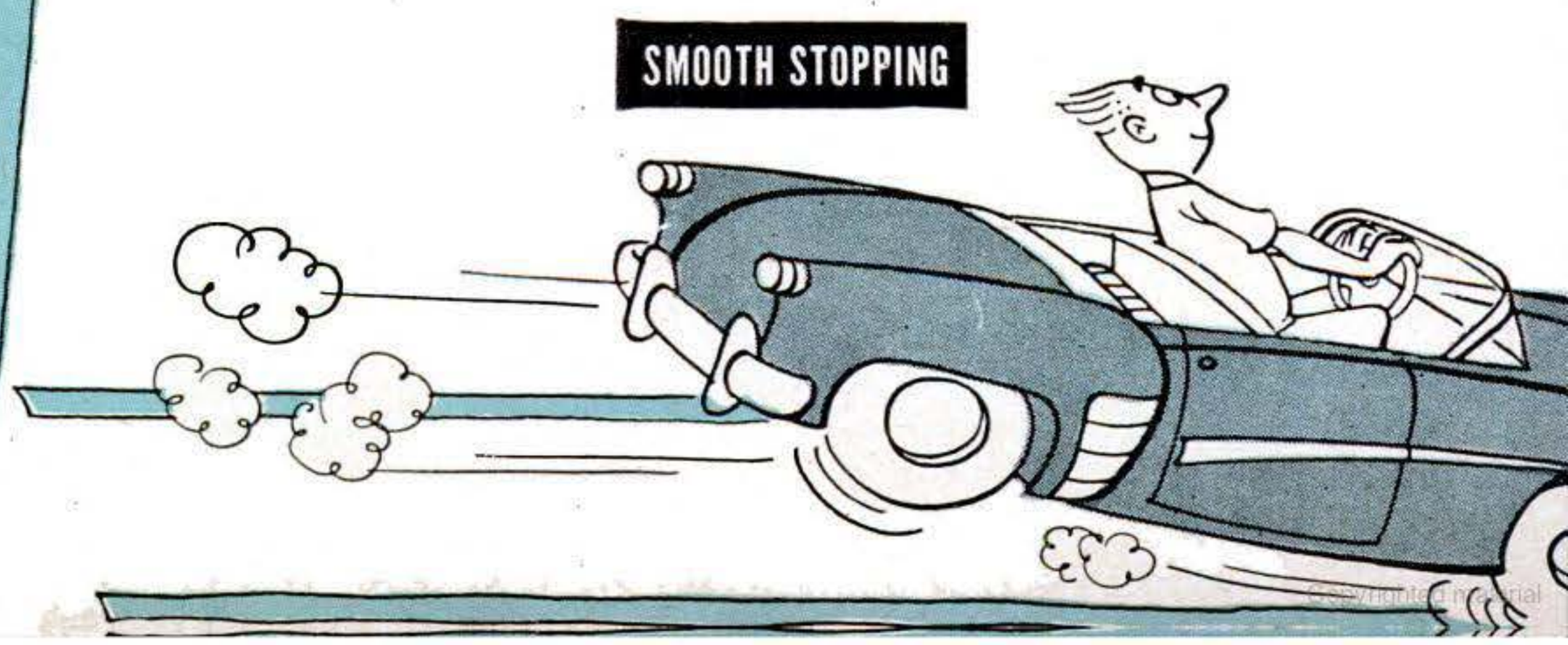
Here's what he must do to win in the finals this month of the National Teen-Age Road-e-o.

By Herbert Yahraes

FOR four tense days this month some four dozen expert young drivers will jockey automobiles over an obstacle course in Washington, D.C., to see which is the most expert of them all.

This contest—the finals of the National Teen-Age Road-e-o—will bring one of the nation's fastest-growing events to a new peak. Two years ago, the first nationwide Road-e-o attracted 30,000 drivers in 265 communities in 34 states. This year about 250,000 high-school students participated in 1,000 local contests. For the first time, each state will have a champion at the national runoff, August 10-14.

This test of how to handle an automobile is so tough that even the way you get into the car can cost you points, and



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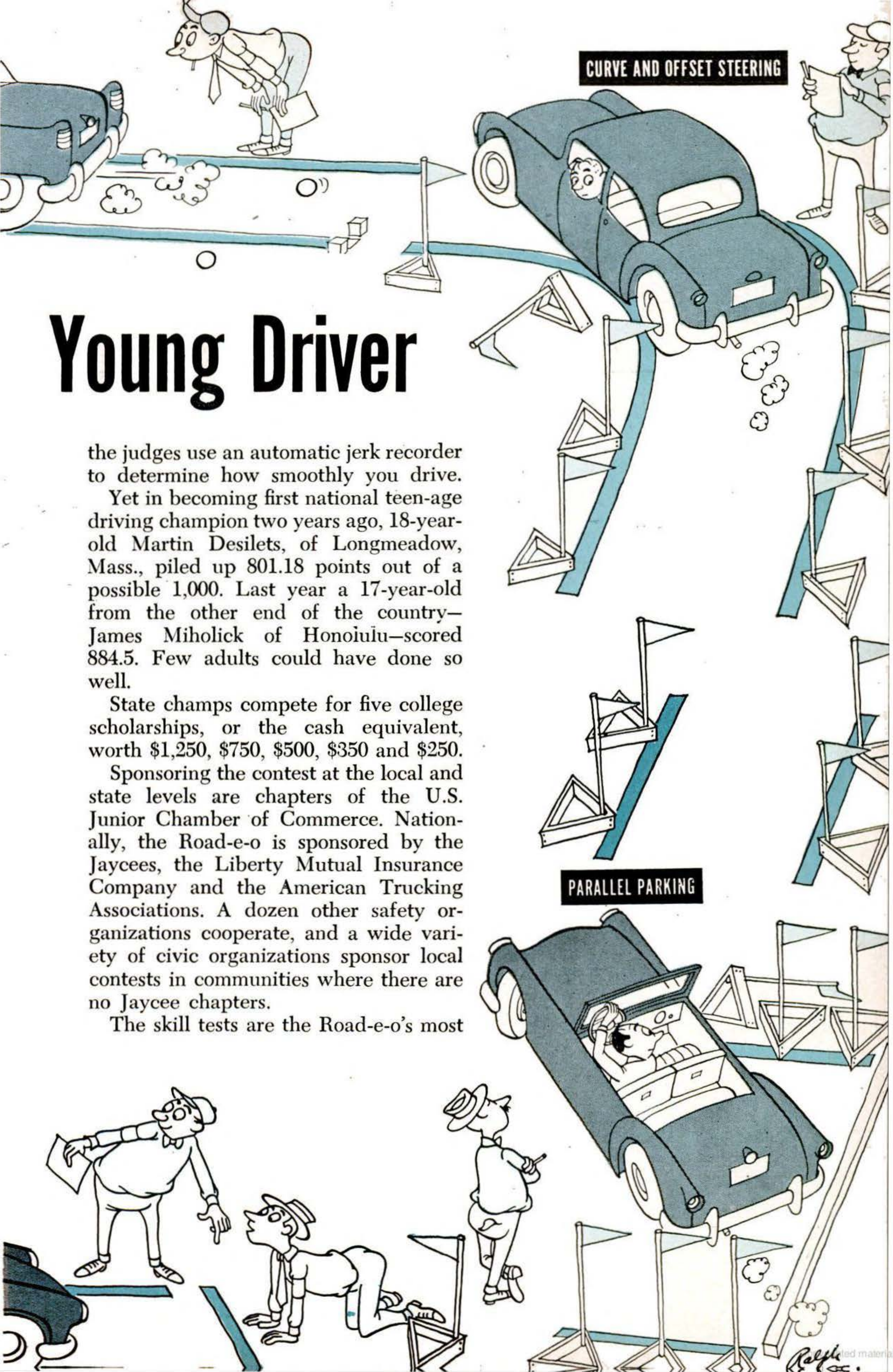


Young Driver

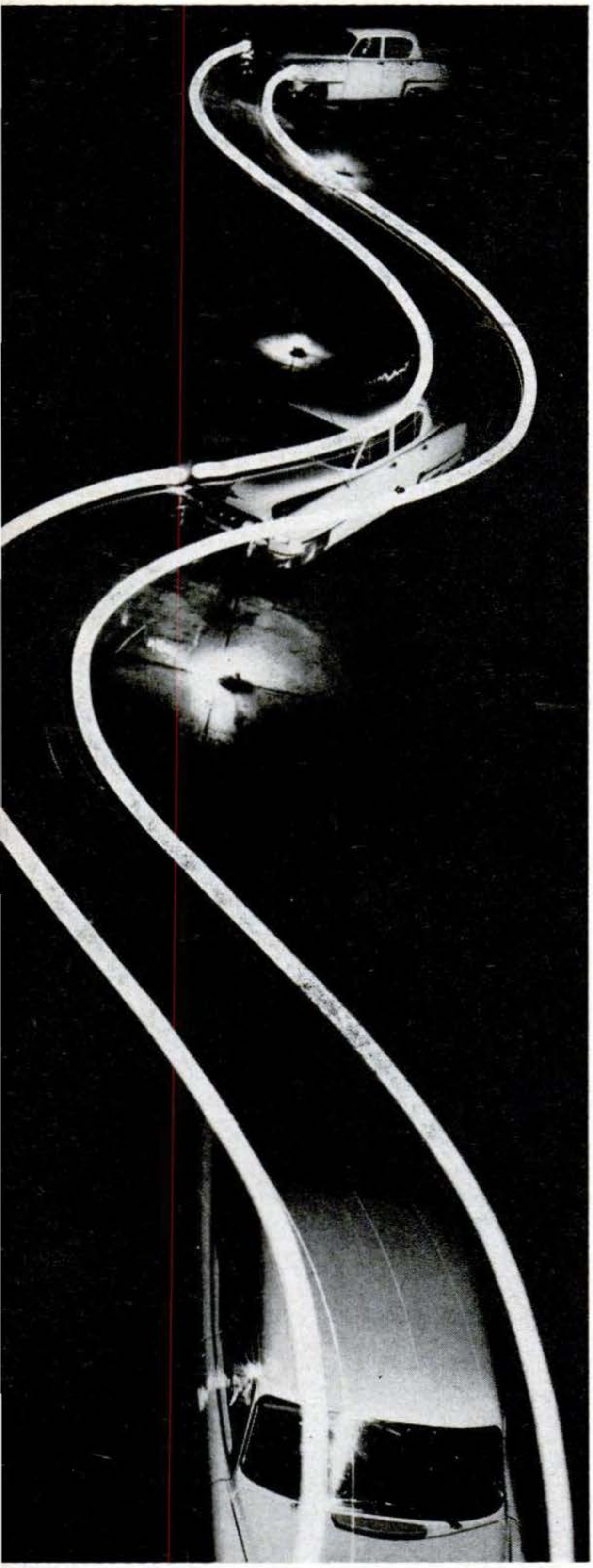
the judges use an automatic jerk recorder to determine how smoothly you drive.

Yet in becoming first national teen-age driving champion two years ago, 18-year-old Martin Desilets, of Longmeadow, Mass., piled up 801.18 points out of a possible 1,000. Last year a 17-year-old from the other end of the country—James Miholick of Honolulu—scored 884.5. Few adults could have done so well.

State champs compete for five college scholarships, or the cash equivalent, worth $1,250, $750, $500, $350 and $250.

Sponsoring the contest at the local and state levels are chapters of the U.S. Junior Chamber of Commerce. Nationally, the Road-e-o is sponsored by the Jaycees, the Liberty Mutual Insurance Company and the American Trucking Associations. A dozen other safety organizations cooperate, and a wide variety of civic organizations sponsor local contests in communities where there are no Jaycee chapters.

The skill tests are the Road-e-o's most



SERPENTINE MANEUVERS are traced by a car's headlights in multiple-exposure photo at night. Entrants thread the course forward and backward, are docked for jerky driving.

spectacular offering. At all three levels—local, state, national—they start with something innocently called Straight-Line Driving. Anybody can drive straight, of course; the trouble is that here you have to prove it by keeping the left wheels of your car in a lane marked by five pairs of teed-up rubber balls, each pair so close together that you graze one if you miscalculate by even a whisper.

No Rubbernecking in Reverse

Going forward is not extraordinarily difficult, but now try it the other way—fine practice for backing down the driveway without touching a newly planted lawn. You get docked for every ball you nudge and for every time you stop. Entrants have picked their way through without grazing a ball but been penalized most of their score for leaning too far out to see where the darn things were.

Next, in the local skill test, you wind your way through a row of barrels sitting in the middle of a space that looks scarcely wider than a one-lane road. You lose points for every instance of jerky movement, uneven speed, and of stopping and backing to avoid hitting an obstacle. Then you do it backwards.

For the third problem, you breeze along for 150 feet, drive through a gateway as narrow as a garage door at 20 miles an hour, and then stop with your front bumper directly over a chalk line. You'll lose two points for every inch you travel past this marker, and one point for every inch you fall short. And if you fail to stop smoothly, you'll lose 15.

Parking: Only Perfection Will Do

All you have to do now is to park parallel to the curb—with points off for failing to make proper signals, backing more than three times, racing or stalling the engine, hitting the stanchions that mark the stall you are trying to get into, and striking the curb.

At the state Road-e-o, the skill test is much the same except that the 'round-the-barrel problem is replaced by some-

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thing called Curve and Offset. You ease around a sharp curve, find yourself in a narrowing right lane, and then swing suddenly but smoothly to the left and straighten out—without brushing any stanchions. Next you retrace your course, backward.

The chief change in the national, except for a general toughening up, is the introduction of a problem that might be called "Please Put the Car Away." Here you turn from the street into a twisting driveway and then into a garage that wasn't built for these wide modern cars. Only a few of last year's state champs got in and out of the garage smoothly.

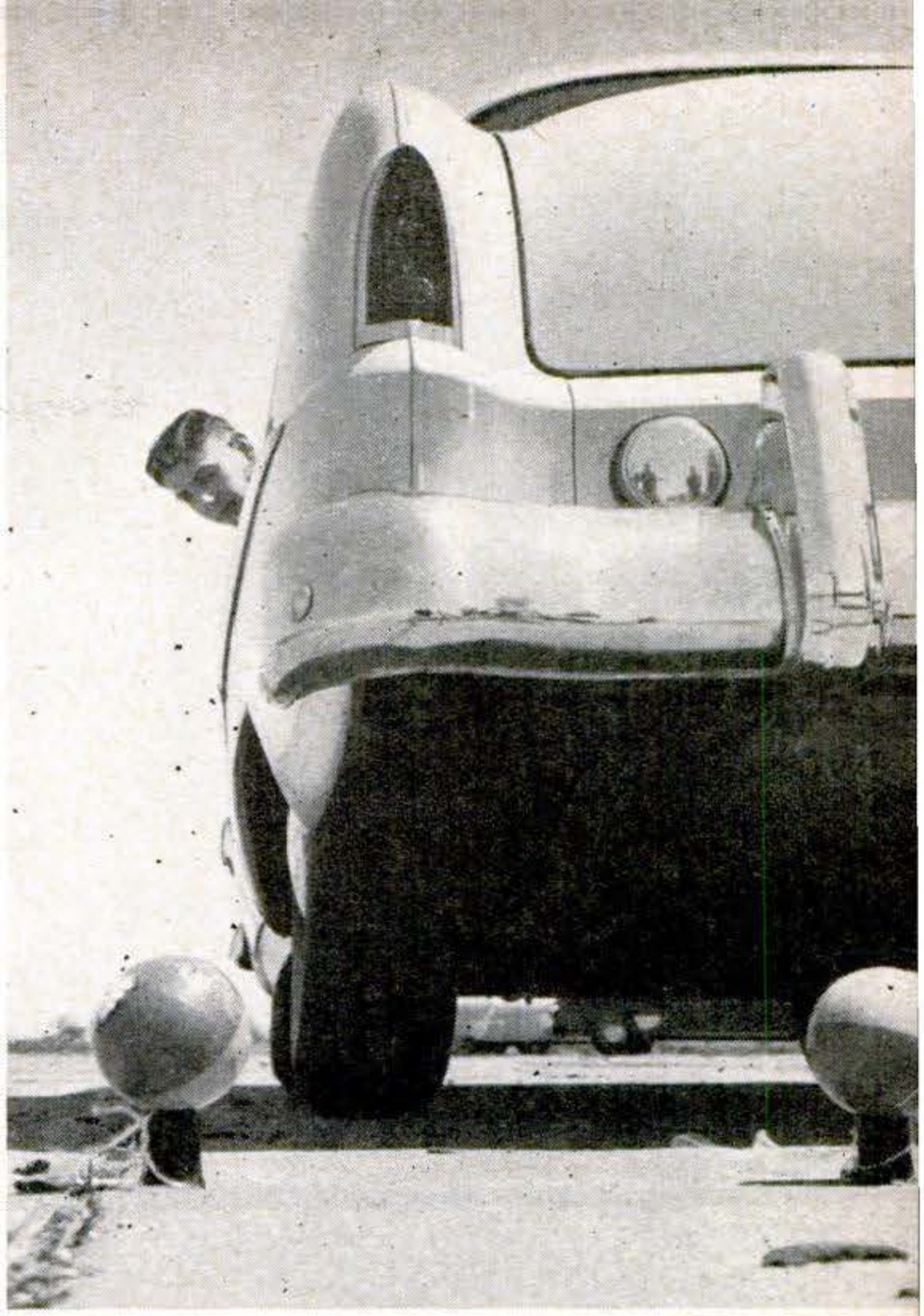
The course was laid out in Washington's National Guard Armory and some of the drivers found it hard to remember that they had to make hand signals even though they were indoors. It was odd to be driving on a wooden floor, too. Furthermore, each champ was using a strange car—a new Ford, Plymouth or Chevrolet, with standard gearshifts. But Road-e-o officials said the teen-agers did amazingly well. "A lot of adults," the course steward added, "can't back out of garages as these kids do."

Show Goes on the Road

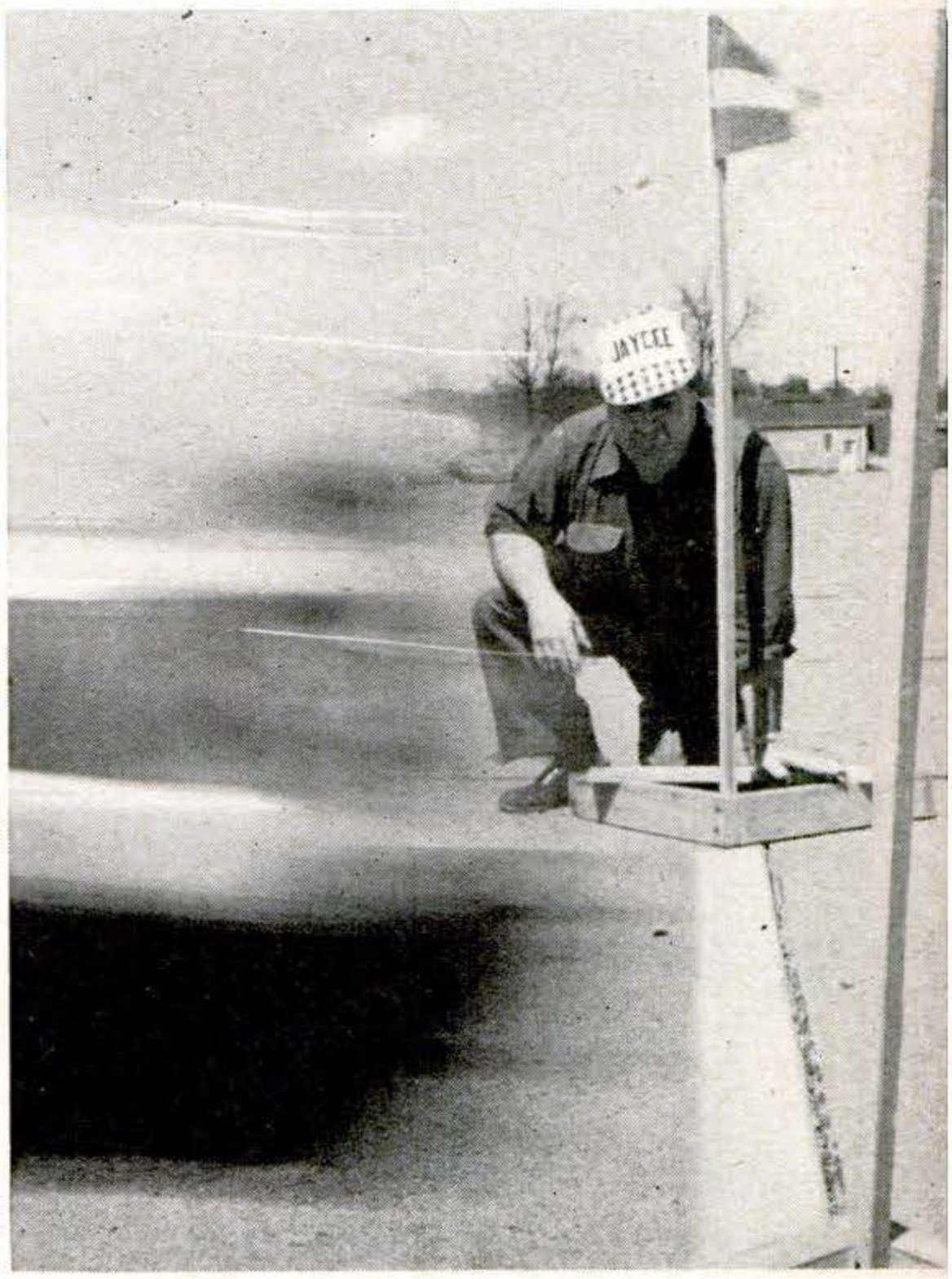
In state and national Road-e-os, the obstacle course is followed by a road check. The one in Washington runs to 7½ miles. All you have to do is drive through the worst of the capital's traffic while a judge sitting beside you in the dual-control car tells you what to do and checks off on his chart how you do it.

It's almost unbelievable how many mistakes can be made in the course of a 20-minute ride. The judge's chart lists 128 possible errors. Thirteen are things you can do wrong just in getting into the car and pulling away from the curb. Others are common driving mistakes. (Do you ride the clutch? Do you scoot across intersections? Do you rest your elbow on the window frame?) Attitude is important, too. Cockiness can cost you a pocketful of points. So, on the other hand, can hesitancy.

[Continued on page 236]



STRAIGHT-LINE-DRIVING TEST requires contestant to keep his left wheels on a path between balls 11½ inches apart. Going forward, he must do this while shifting up one gear.



STOPPING SMOOTHLY, driver must brake down from 20 m.p.h. in 40 feet and stop with his front bumper directly above the white line. Performance is measured in half-inches.

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Italy's Plates Light Up

ITALIAN traffic cops are going to have a lot less eyestrain—and speeders a lot more tickets—if a new license plate now on trial in Rome is adopted for official use.

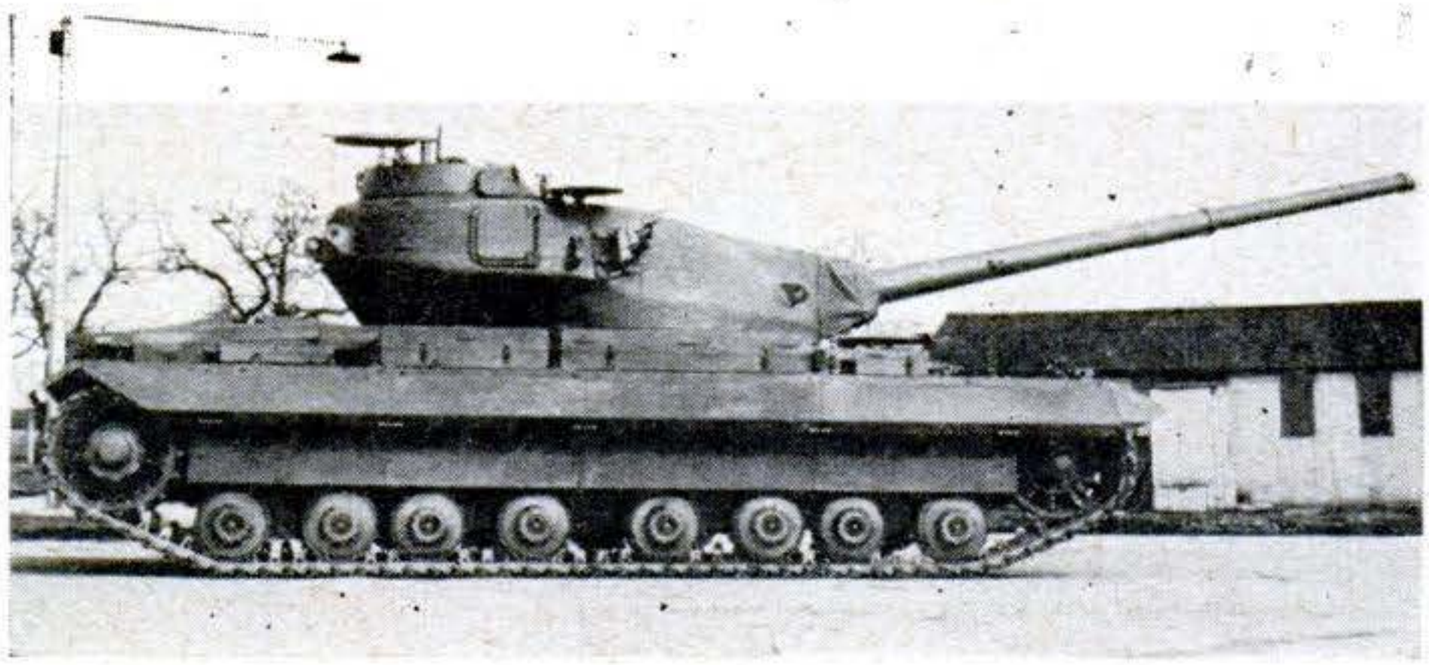
Numbers made of white transparent plastic are set over cutouts in the metal and lighted by a lamp behind the plate.

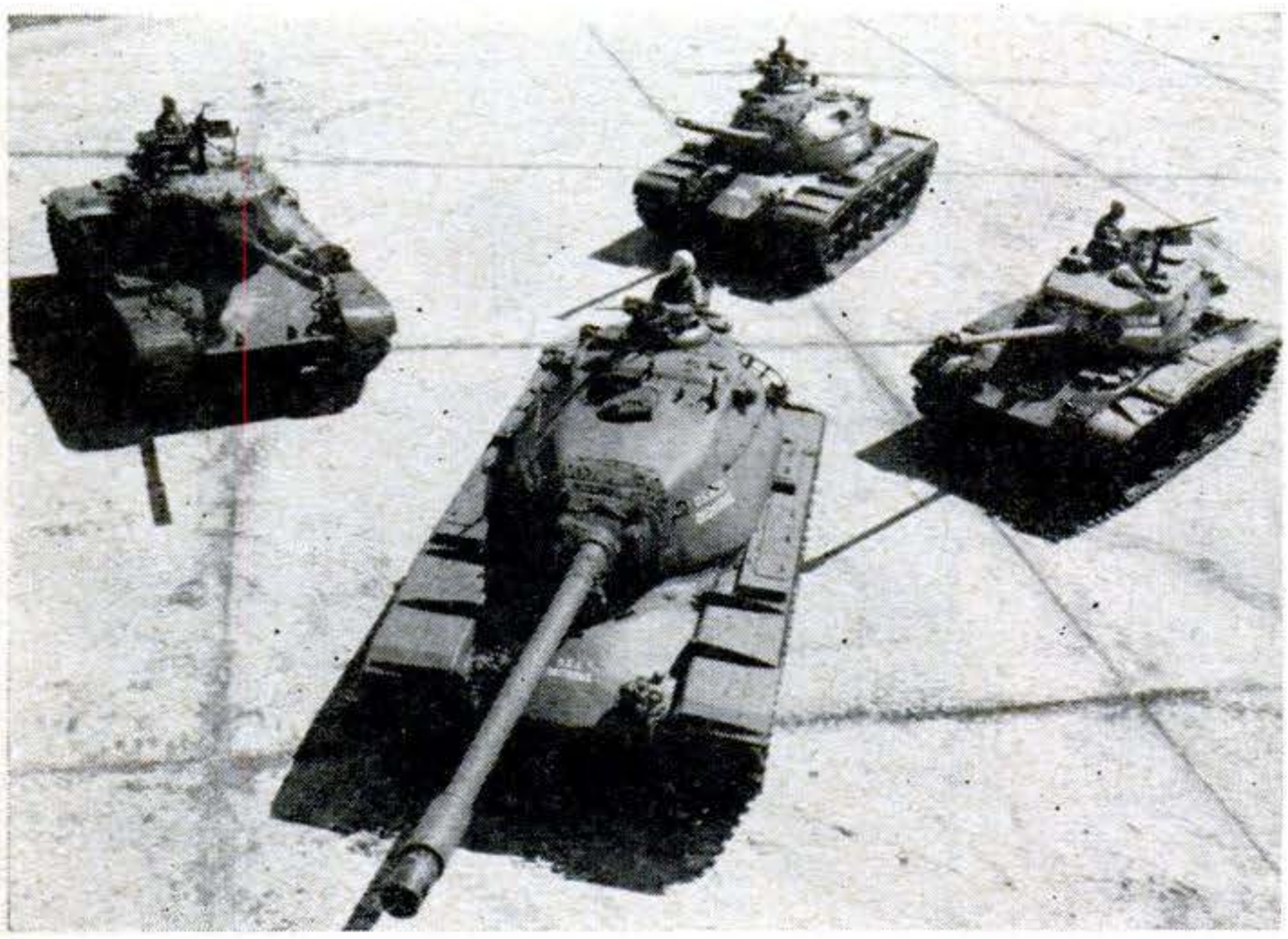
As shown in the photograph, the illuminated plate on the right of the car is considerably easier to read, especially at night, than the regulation license plate carried on the car's left.

▶▶▶A new process impregnates paper with a chemical that kills germs. It is expected to be used in making napkins, soda straws and paper cups. And bakeries can now buy waxed wrappers with a built-in aroma of fresh-baked bread, white or rye.

New Big British Tank Gits Thar Faster

FAST and highly maneuverable, Britain's newest heavy-gun tank—the Conqueror at right—is so big it's said to dwarf a previous type that weighs 49 tons. Actual details are secret except that it carries a four-man crew.





New Big U.S. Tank Packs the Mostest

OUT in front at left is Uncle Sam's mightiest tank—the long-secret T-43. The 60-ton monster mounts a long-barrel, 120-mm. gun—enough firepower to outslug any tank in the world. Three machine guns on the turret can be loaded, aimed and fired from inside to protect the tank's five-man crew. Behind the T-43 are an M-47, a Patton-48 and a Walker Bulldog, all postwar tanks.

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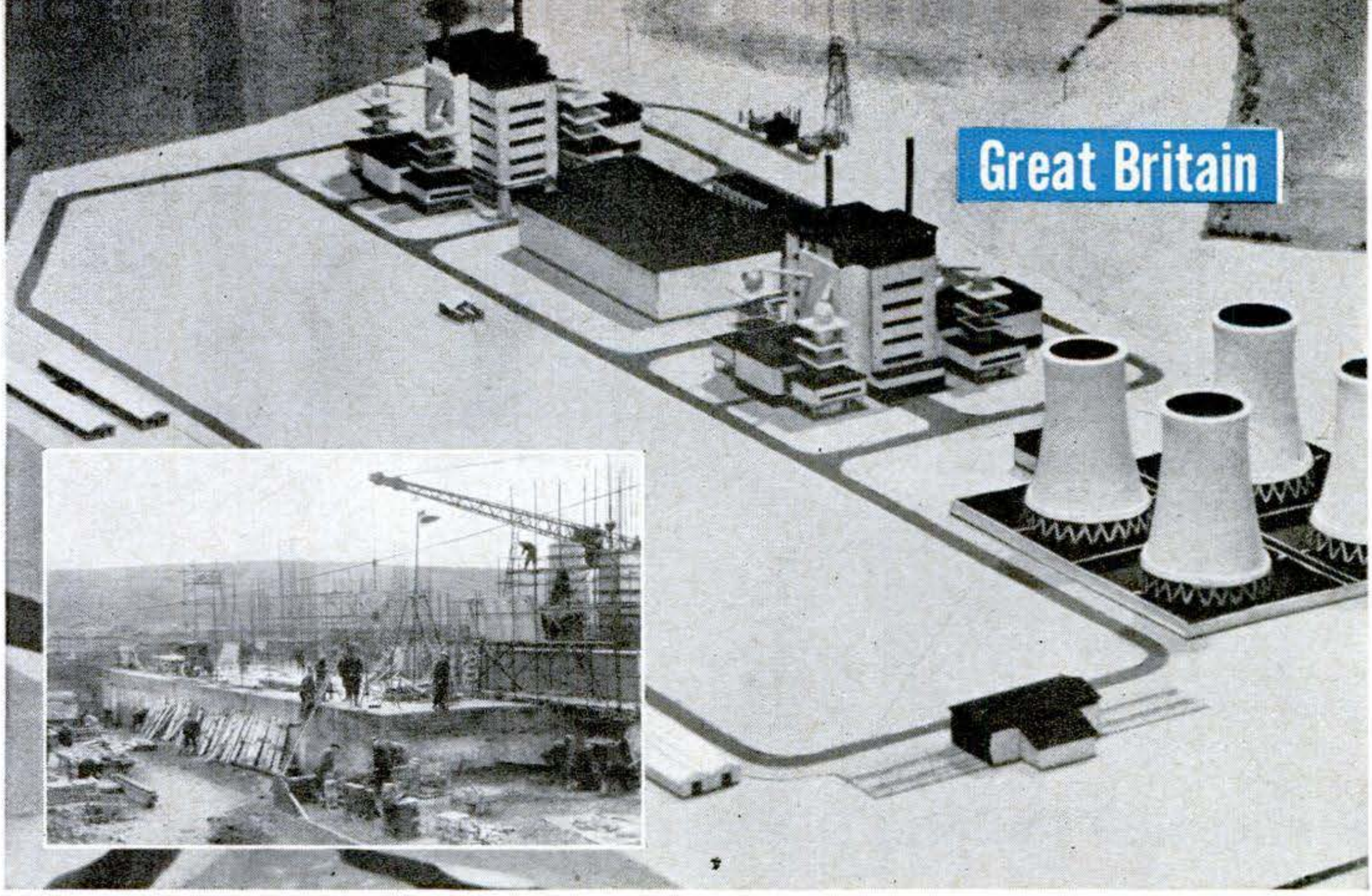
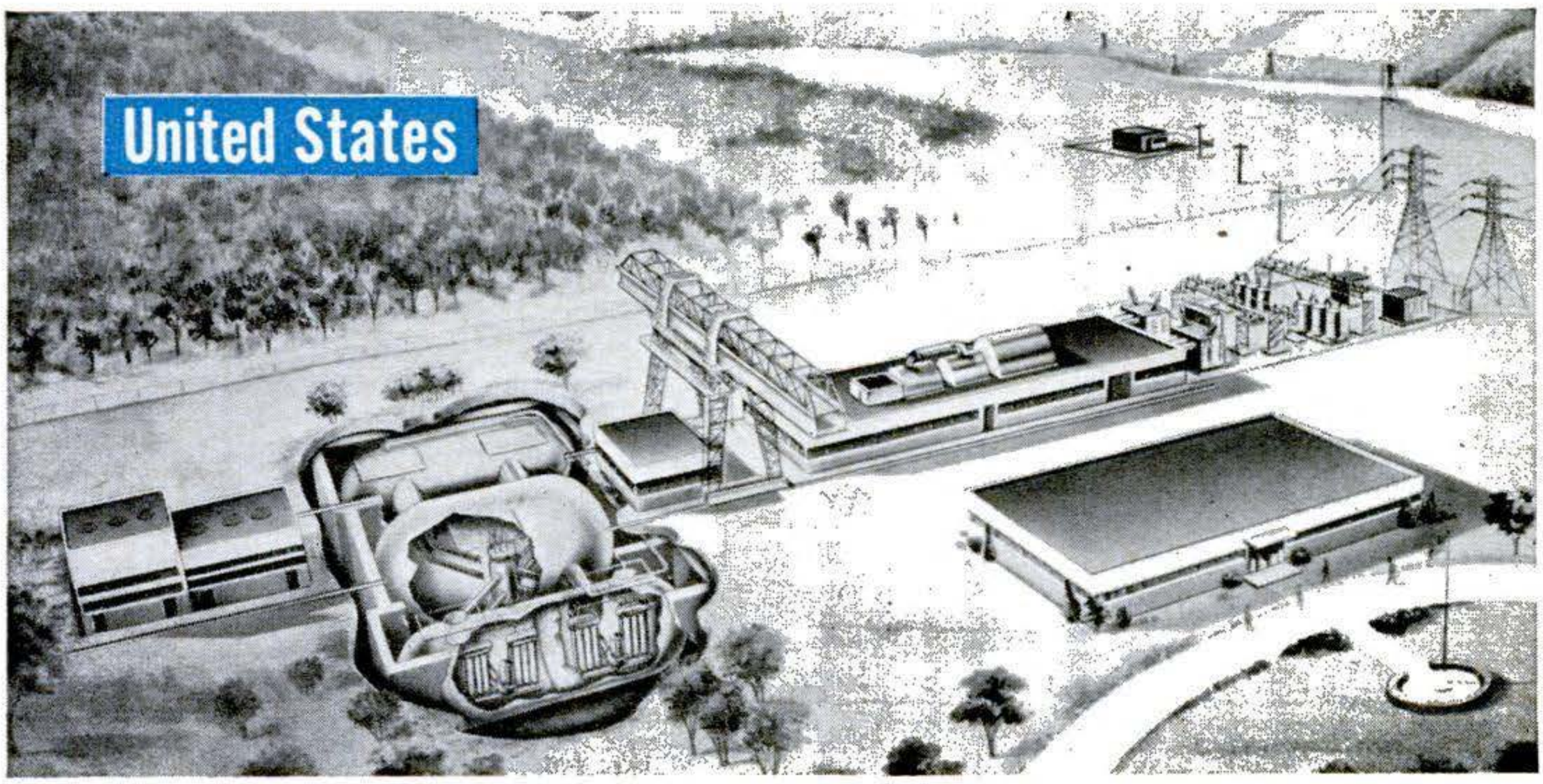


England's first atomic-power plant, fast being built (inset), will look like this model.

Britain Leaps Ahead of Us in Race for Atomic Power

GREAT BRITAIN is a broad jump ahead of the U.S. in the effort to produce electricity from atomic energy. The walls of England's—and the world's—first commercial nuclear-power plant are already rising from the pastures of a former dairy farm in the mountainous county of Cumberland. The plant is expected to start producing around 50,000 kilowatts of electricity by the fall of 1956.

The first American atomic-power station, to be run by the Duquesne Light Co. of Pittsburgh, is still in the blueprint stage, with only an artist's conception (below) to show how it may look when, in 1957, it begins putting out 60,000 kilowatts.



The first U.S. atomic-power plant, to be built at Shippingport, Pa., may look like this.

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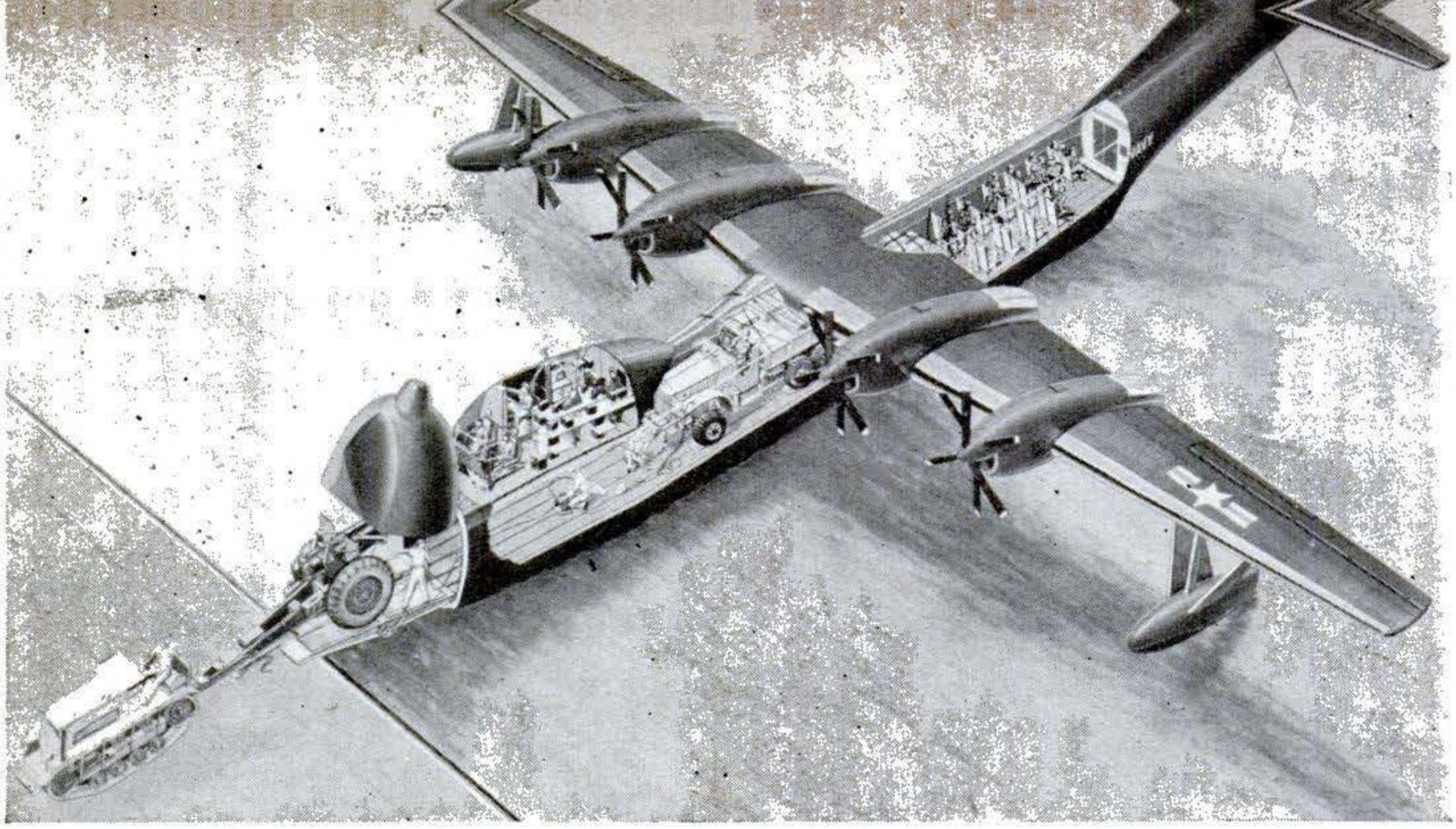
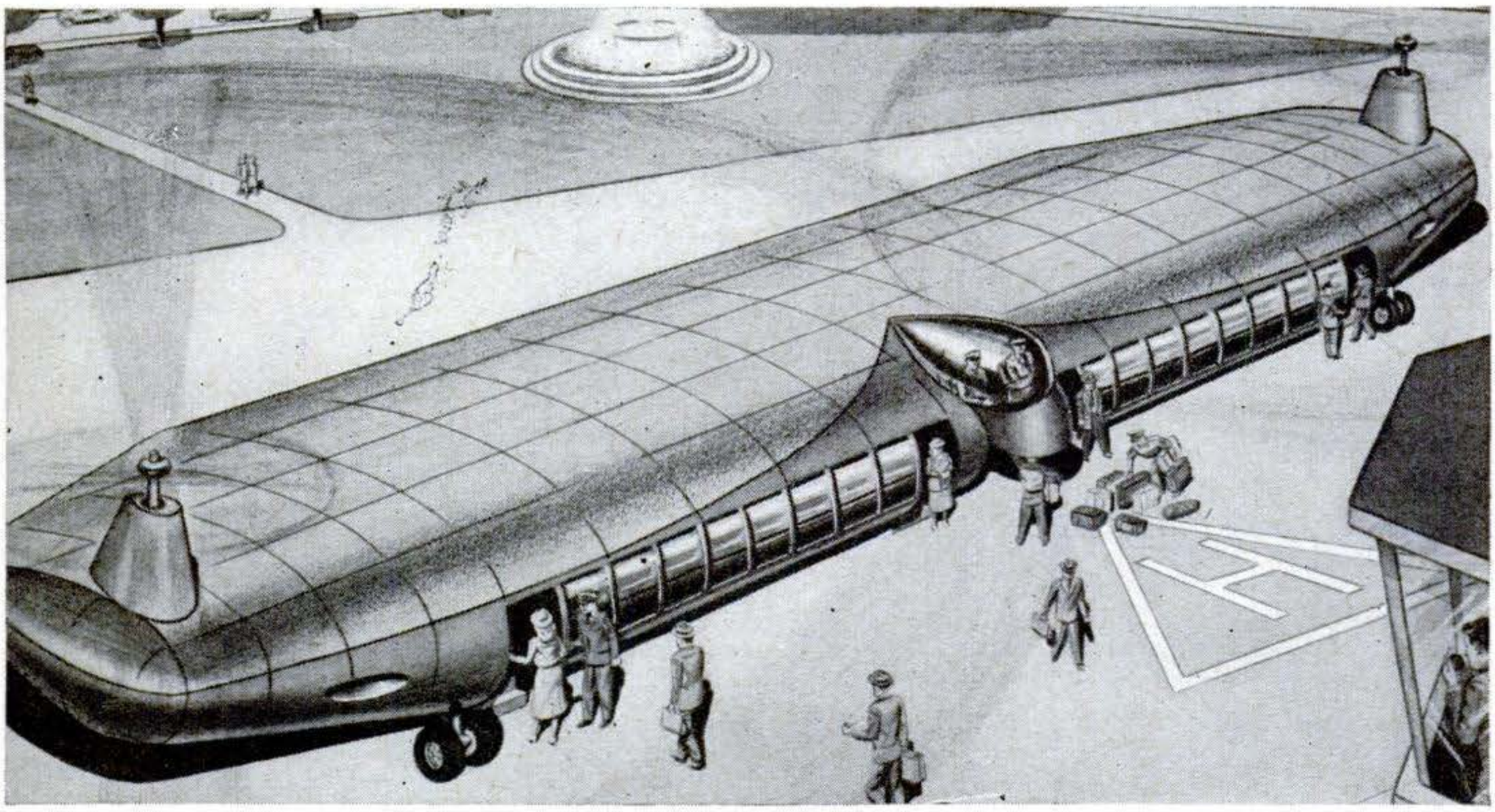


Flying LST to Land Troops, Guns on Beach

WHAT the famed water-bound LST landing ship did during World War II, this flying version can do, but hundreds of miles an hour faster. It is the R3Y-2, a nose-loading model of Convair's turboprop Tradewind. In action, the big plane will land offshore and taxi to the beach. In a matter of seconds a bow ramp will be lowered to unload Marines, guns, trucks and supplies. To pull away from the beach, the pilot, sitting in an upper-deck crew compartment, will simply reverse his props and back up.



All-Wing Helicopter to Fly Sideways

A FLYING-WING passenger helicopter is the newest idea in whirlybirds. It would travel sideways instead of pointing its nose in the direction of flight.

The novel scheme was born when Bell Aircraft pilots were testing a Navy anti-submarine, tandem-rotor helicopter. During test flight, the pilots began to favor sideways flight because "it just felt better." From there on company engineers took over and came up with the sideways-flying design shown in the drawing above. They claim that it will be more efficient, since the wing itself will supply some of the lift. Thus less power will be required from the rotors, saving fuel.

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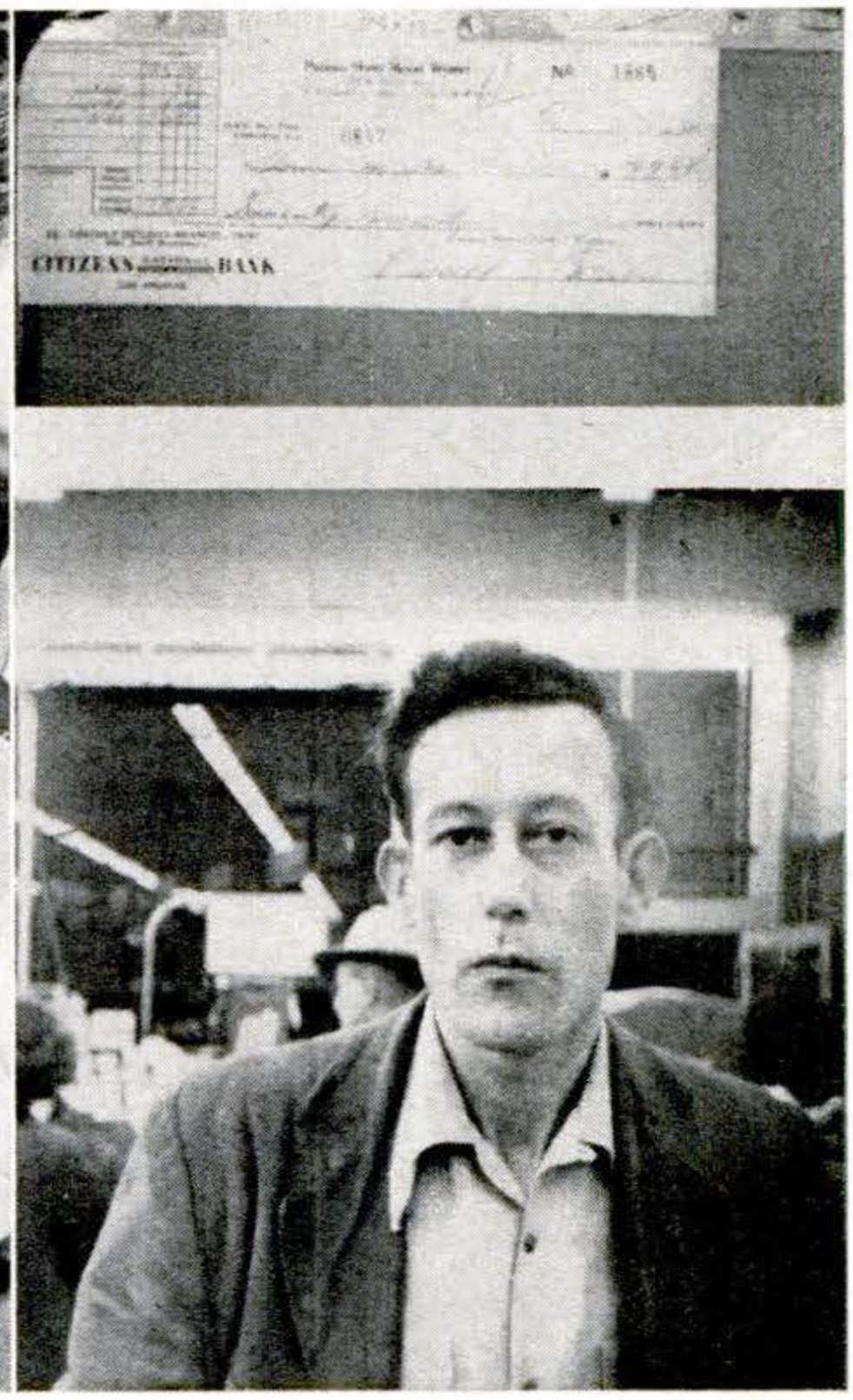

Double-Eye Recording Camera Traps Bum-Check Passers

WHEN Thomas M. Lee cashed a check in a Los Angeles supermarket he saw the clerk photograph the check in a new machine. What he did not see was that the machine also photographed him—through a lens concealed behind one of the check-mark symbols in its front (above left). That's how Lee's picture (above right) got on a man-wanted circular issued by the Los Angeles Police Dept. The cops say the check was forged. The machine is distributed by Dubl-Chek System, 8301 Sunland, Los Angeles.

Troopers Set Road Traps for Trucks That Tote Too Much

DRIVERS of overloaded trucks are casting a wary eye around corners of California roads these days. Lying in wait may be a framework of metal holding four scales. If a truck driving over the weighing platform carries cargo too heavy for the number of its axles, a state trooper hands the driver a court summons. Surprise is what catches the guilty—truckers never know when the rig will be set up along their routes.

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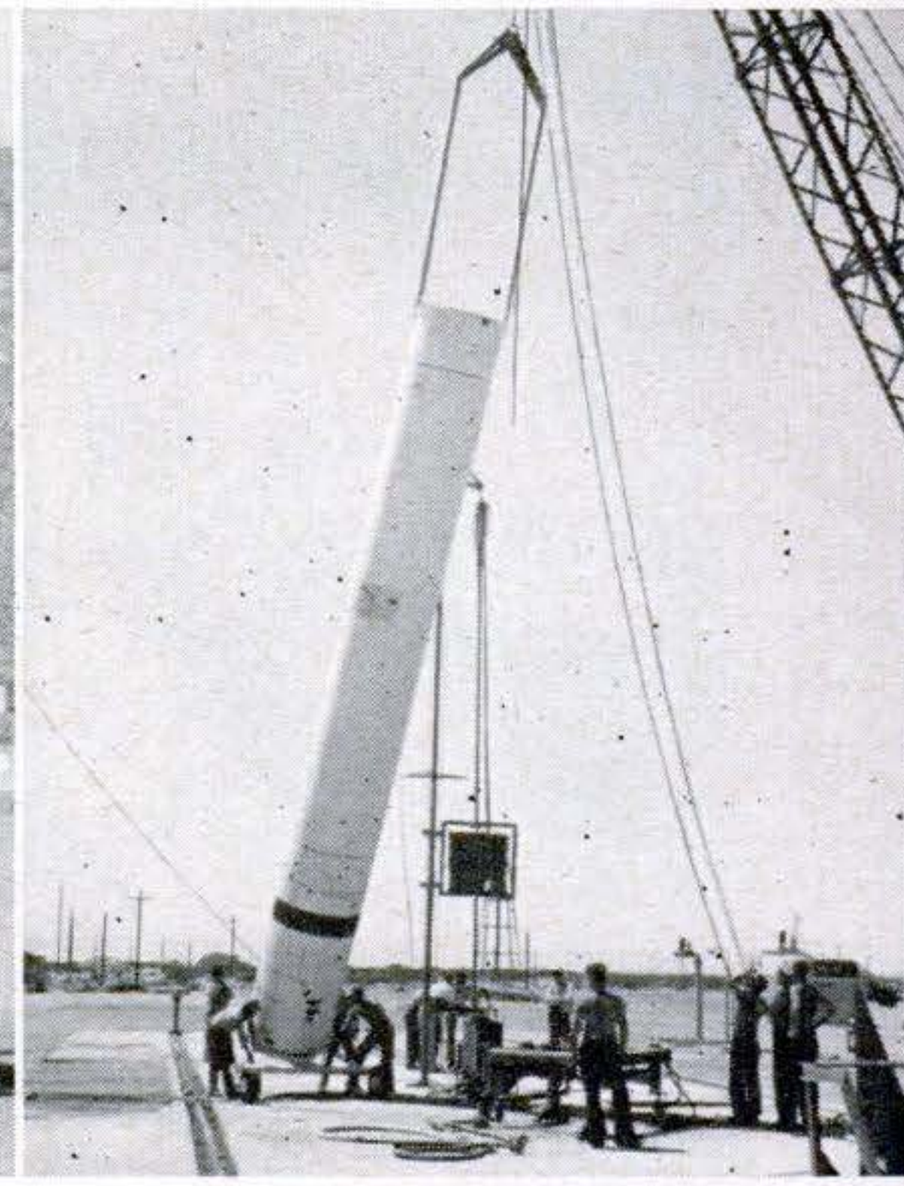
How to Shoot 158 Miles... Straight Up

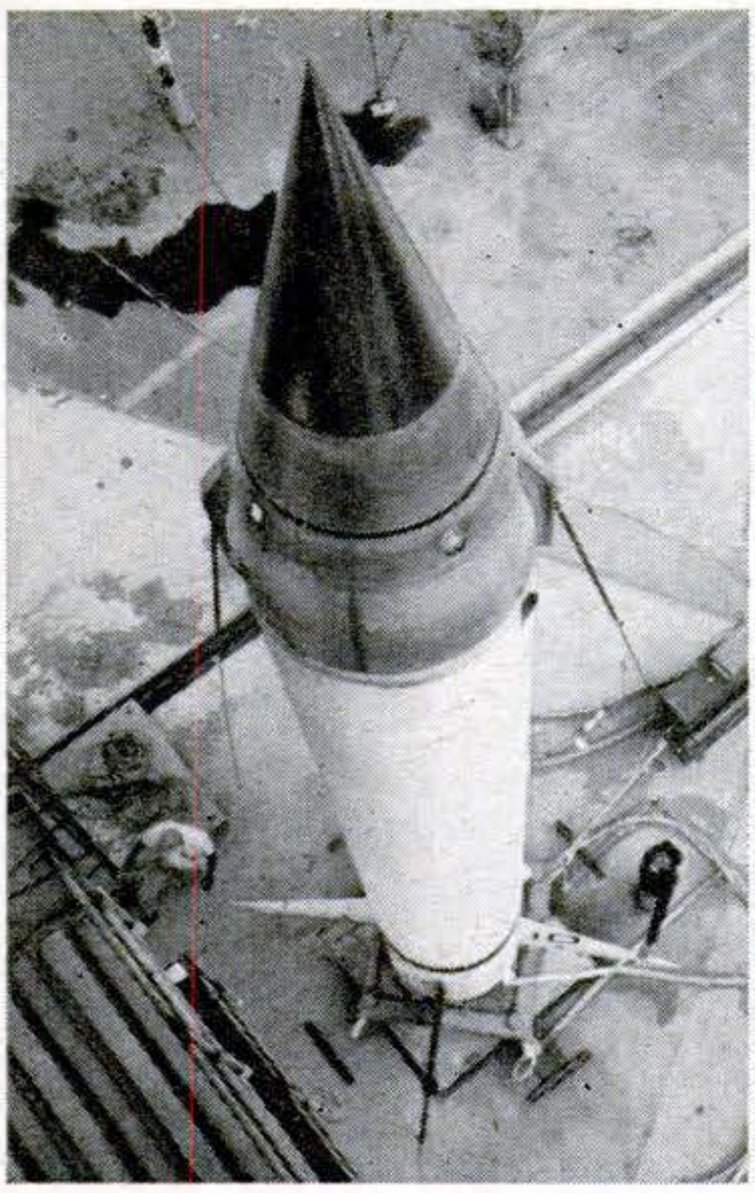
The slender cylinder being towed by the jeep in the picture below could be full of carrot juice or cooking gas. Actually it's full of delicate machinery, it's worth half a million dollars, and it's about to be shot almost 160 miles straight up—29 times higher than Mt. Everest.

Shooting a rocket into space is a complicated business, as shown by these pictures of the Viking missile—the most elaborate

1 ROCKET RIDES to launching area on three wheels. Its engine, made by Reaction Motors, delivers thrust of 20,000 pounds on diet of liquid oxygen, alcohol, peroxide.



2 INTO GANTRY FRAME goes rocket to get nose, tail. Nose totes instruments.



3 TOP POLISHED LIKE MIRROR, missile is now ready for fuel. Total length: 45 ft.

4 FIREPROOF-SUITED CREW pumps highly explosive peroxide into fuel tanks.

5 FIRING TIME is only minutes away as Viking poises on small launching platform.

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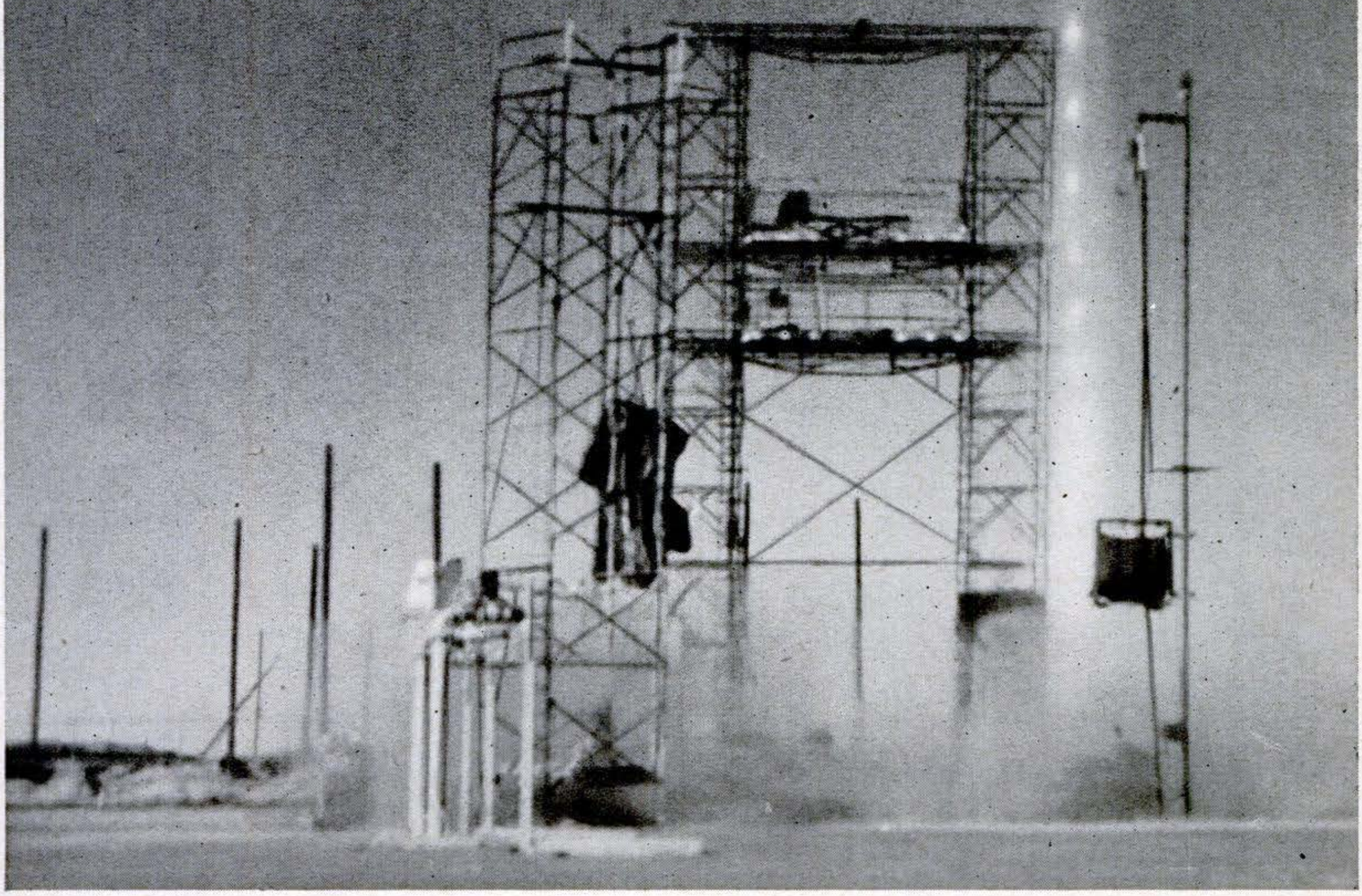
ever released by the Government's White Sands Proving Ground.

Looking like an overgrown stovepipe, it must be hauled to the shooting site and have its needle nose and tail fins added. It is fueled as its liquid oxygen—at *minus* 300 degrees F.—boils.

Built by the Glenn L. Martin Co., this type of rocket holds the new single-stage height record of 158 miles.

WRECKAGE FROM CRASH on return to earth is studied for the effects of high altitude.



6 THUNDEROUS ROAR of engine sends 7½-ton rocket skyward. Blanket that insulated liquid-oxygen tanks from desert heat has been removed. Missile, automatically radioing information on conditions in space, will reach speed of 4,300 miles an hour during flight.

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Racer Doubles for Plane to Test Retractable Parachute

THIS racing car is trying out a new air brake—for airplanes. The brake is a retractable parachute designed to slow fast-landing jet planes. To test it without the bother of actually flying a plane, British engineers released it when the car hit 140 m.p.h., then pulled it back in by a motor when the car had slowed to 55.

Beavers Air-Dropped to New Sites to Engineer New Dams

BEAVERS living in forests overcrowded with them, and amply supplied with dams, are being airlifted to new homes where more dams are needed. U.S. Forest Service men capture the animals (above left) and pack them in pairs in boxes so they can be dropped by parachute (above right) to colonize remote mountain areas. As the box touches the ground, it springs open automatically and mama and papa beaver scamper off to found new settlements.

Beavers were formerly transported into the wilderness by pack horse, but on the long journey they often became overheated and died. Flown in, they arrive in good health and take the jump undisturbed.

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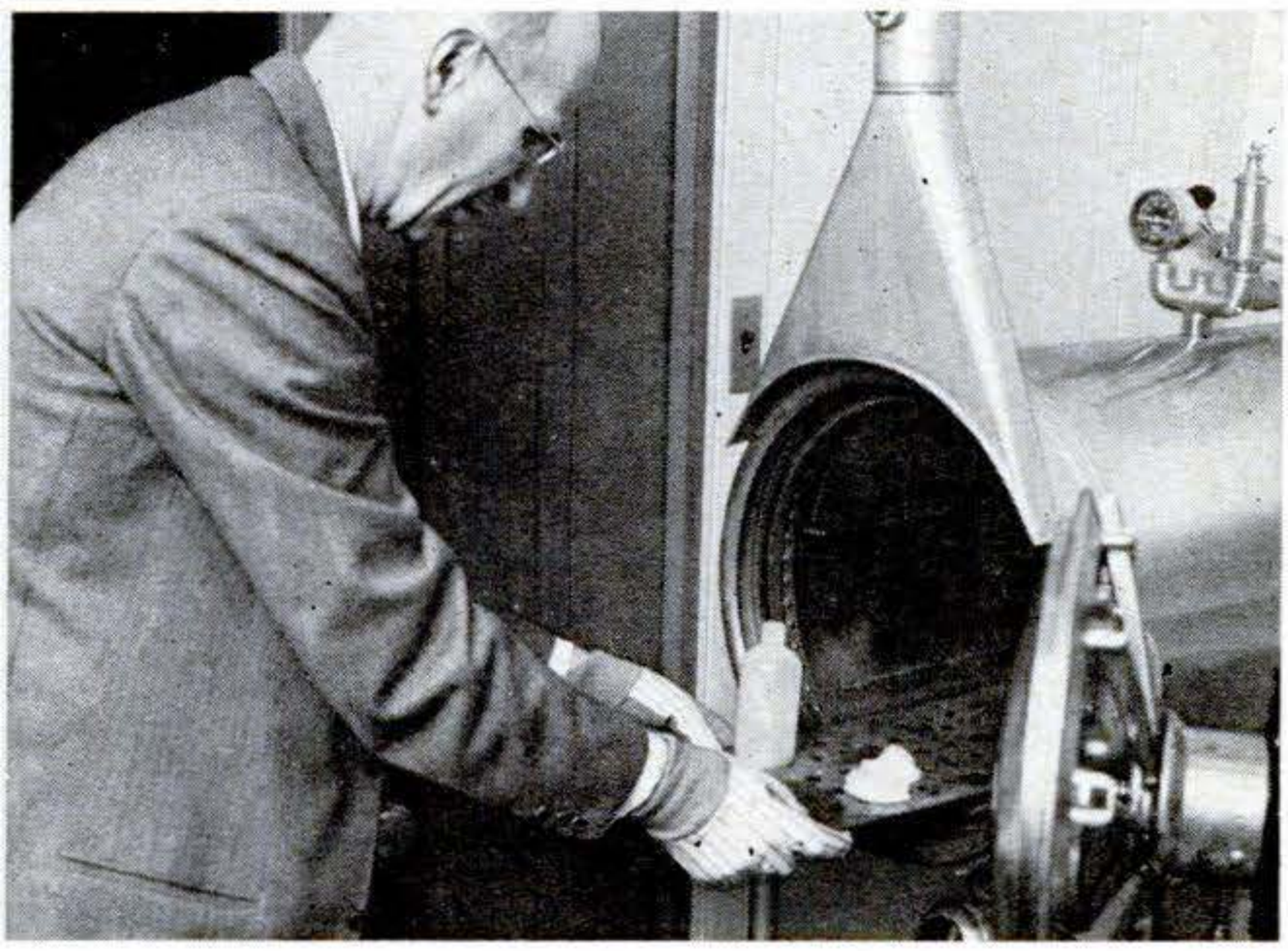
Atomic Pram Totes Hot Toiler

WORKMEN leaving hot areas in a British atomic plant are not allowed to walk through the corridors. They might spread radioactive dust from their clothing. So they get ceremonious rides, like ancient kings, moving from place to place on a special cart hauled by another workman.

▶▶▶Auto components get a rough workout at GM's newest test station—it's on Pike's Peak. Engines, transmissions and carburetors are subjected to high-altitude and steep-grade checks.



X Rays Make Plastic Tough

AT THE sterilizer above are two plastic bottles. That's right, two. After sterilization at 250°, one bottle is just a blob. The other, previously bombarded by electrons from a million-volt X-ray machine, is not affected by the heat. General Electric plans to market such heat-resisting bottles soon, foresees plastic hot-water pipe.

Detector Knows Iron from Gold

THIS detector can tell one metal from another. It signals loudly when iron is present, decreases in tone when gold, silver or other metals are found. The Gardiner Electronics Co., 2018 N. Dayton St., Phoenix, Ariz., says it will locate gold nuggets in streambeds, coins in beach sand, and pipes, wires and electrical boxes in walls.

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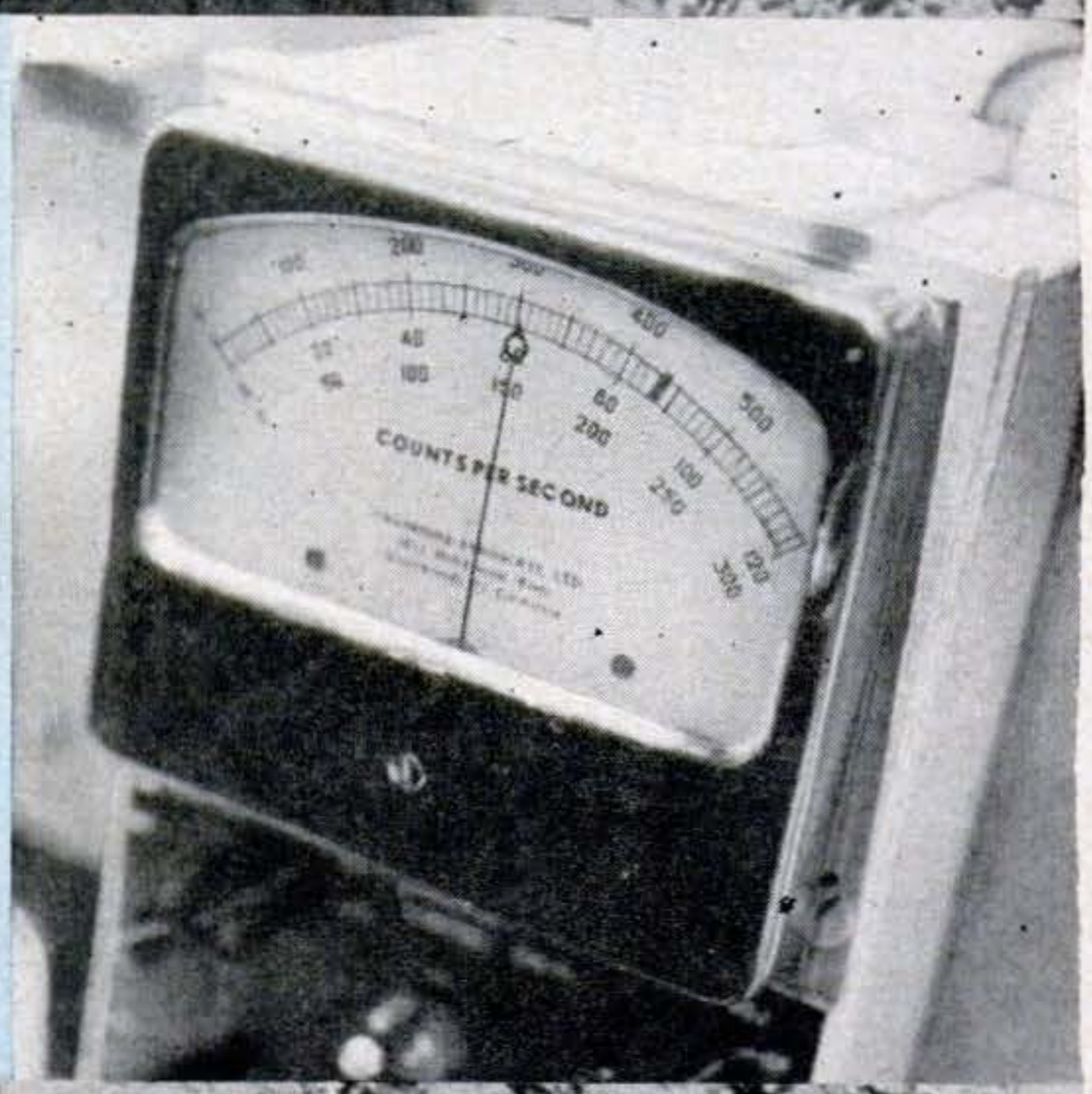
Finding



"RIM FLYING" is modern way to find uranium in Colorado Plateau region. As plane almost grazes canyon wall, radioactivity from deposit registers on instrument at right, mounted on back of pilot's seat in view of geologist behind him. Plane is flying for Kerr-McGee Oil Industries' Navajo Uranium Division, one of most successful users of airborne prospecting.

Fortunes in Uranium

Along canyon rims and roadsides, by air, and in the depths of old ghost mines, U.S. prospectors again are striking it rich.

By Alden P. Armagnac

A LADY rockhound hunting specimens in Arizona came upon several petrified trees. They had turned to rock of such a peculiar yellow color that she chipped off samples of it and took them to the state geologist. It was carnotite, an ore of uranium, and the logs contained 200 tons of the mineral, worth a small fortune.

Another amateur rockhound, a Colorado high-school janitor, found an outcrop of uranium ore on the eastern slope of the Continental Divide near his home. Weekends and vacations, he shoveled away at it, until he had a carload to ship to a Government purchasing depot. Now the Atomic Energy Commission has declared his find an important one, miners are working for him to exploit it, and he's a janitor no longer.

A 34-year-old Utah prospector has sold $2,500,000 of the dull black rock that his diamond drill struck while he was seeking canary-yellow carnotite ore. His black stuff was uraninite, the most prized of uranium ores—pitchblende is one variety of it—and one rarely found in this country.

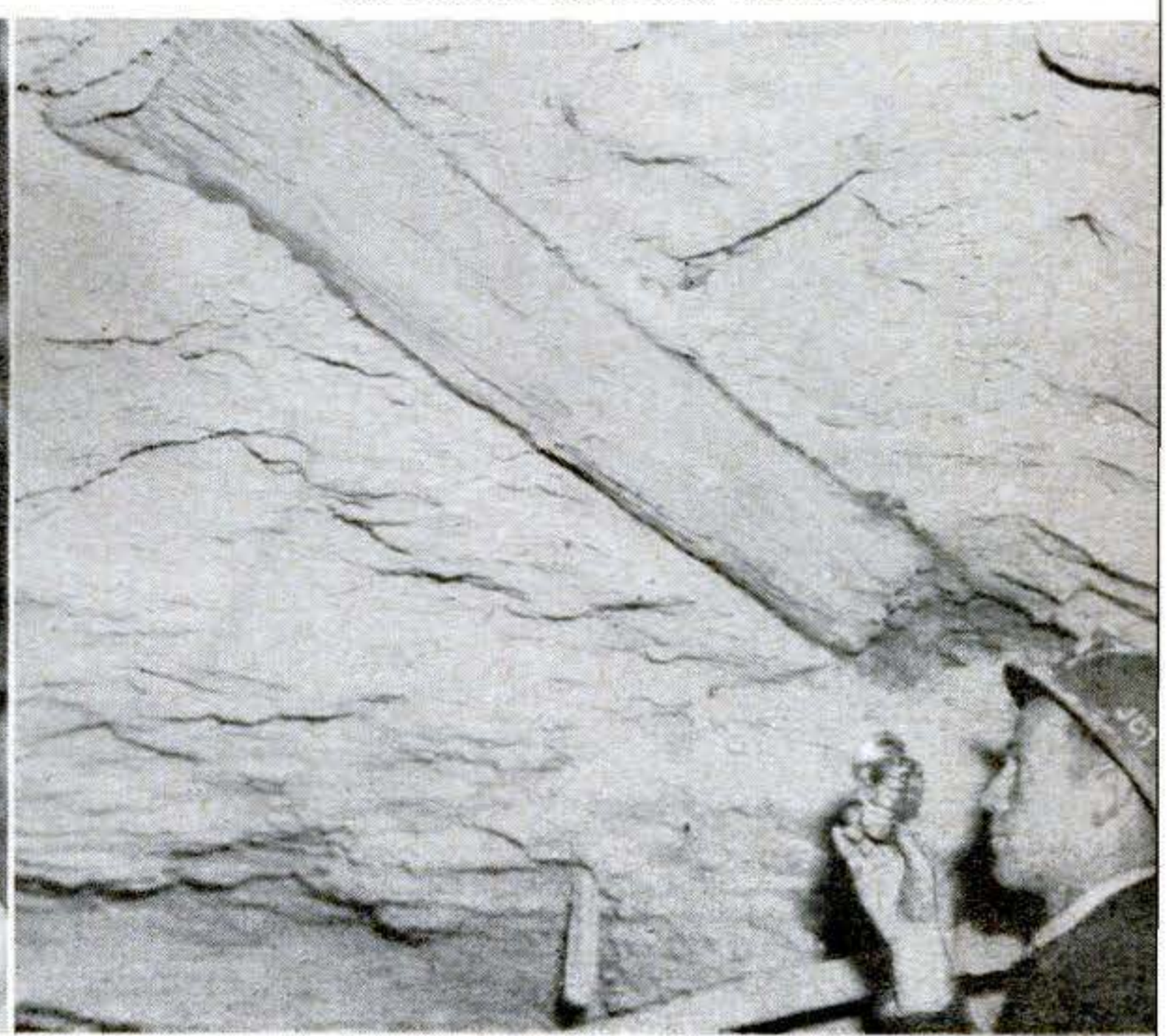
Production Soars Under AEC Spur

By guaranteeing to buy uranium ore at generous prices for years to come, and by offering handsome bonuses for discovering it and starting new mines, the Atomic Energy Commission has spurred U.S. production. At the latest tally, more

MILLION-DOLLAR GRIN is worn by Charles A. Steen, 34-year-old geologist and prospector, after he hit uranium jackpot by discovering a fabulous uraninite lode near Moab, Utah.

PETRIFIED LOGS of Colorado Plateau, like this one in mine, are rich in high-grade carnotite. Biggest may yield 100 tons apiece.

Photo from Engineering and Mining Journal



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UP THERE AND DOWN HERE, in underground workings, Colorado Plateau miners find carnotite-ore pockets scattered through rock. This scene is in larger-than-average mine.

than 600 mines in this country were yielding uranium. U.S. output has outstripped Canada's, and it now ranks second only to that of the world's richest source, the Belgian Congo in Africa.

Anyone can get into the act. It's like the days of the forty-niners all over again. This time it's in modern dress—in an era of jeeps and planes, of neon signs and plastic-and-chromium trimming. But it's the same irresistible, age-old lure of fortunes in mineral treasure.

The uranium hunters' Klondike, the Colorado Plateau carnotite district, extends over western Colorado and parts of New Mexico, Arizona and Utah. This booming area's mesas, flat-topped hills of red and buff sandstone with rugged canyons between, are dotted with sagebrush and uranium workings.

If you see a hole burrowed into a canyon wall near a mesa top, a few timbers, perhaps a bit of rickety-looking track, that's a carnotite mine. If you expected big buildings, excavations and rock piles, you'd go right by one without knowing it.

Someone and his pal scrape together an air compressor and drill, picks and shovels, a one-ton ore car or just a wheelbarrow, and they're in business. They push a filled ore car by hand to the mine entrance—or, if pickings have been good, they may treat themselves to a small mine locomotive. You can buy one powered by compressed air, seen in the picture on this month's cover, for the price of a car: $1,420 and up.

Pocketfuls of Money

These are midget mines, and for good reason. Most of the ore deposits scattered through the sandstone are small pockets, of only a few hundred tons or less. But once in a while the deposits run to exceptional size. Fifteen have been discovered to date that contain more than 100,000 tons of carnotite ore apiece. Generally a lode of such size has a gross value of more than $3,000,000.

"Rim-walking" prospectors checking surface rocks with Geiger counters, or just looking for the yellow color of carnotite outcrops, have still to search innumerable miles in outlying parts of the district. But in the 50-mile strip called the Uravan Mineral Belt, where the hunt has been most intensive, most new deposits are being found today by sinking drill holes from the mesa tops. Depending on how deep ore is struck, it's mined by removing the surface layer or by driving a tunnel inclined gently from the surface—or, below 200 feet, by sinking a vertical shaft. Horizontal tunnels bore into the more easily mined outcrops on the mesas' sides.

Pay Dirt for the Santa Fe

The Colorado carnotite deposits, long considered a geological rarity, now are known not to be unique. Recent discovery of similar ones in the Black Hills of South Dakota has opened a new uranium field. And a railroad has found itself the owner of a uranium mine because a Navajo Indian sheepherder, who had seen ore samples at a trading post, recognized carnotite in limestone rock along the Santa Fe right of way near Grants, N. M.

A curious variety, asphaltic carnotite, is being exploited at Temple Mountain,

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Utah. Ores containing both uranium and copper have turned up in southern Utah and Arizona.

Carnotite and other bright-hued deposits are "secondary" uranium minerals formed by weathering and chemical change from original deposits of "primary" uranium minerals, dissolved by ground waters and scattered afar. Much richer are deposits of primary uranium minerals like Africa's and Canada's black pitchblende. Some have been found in this country.

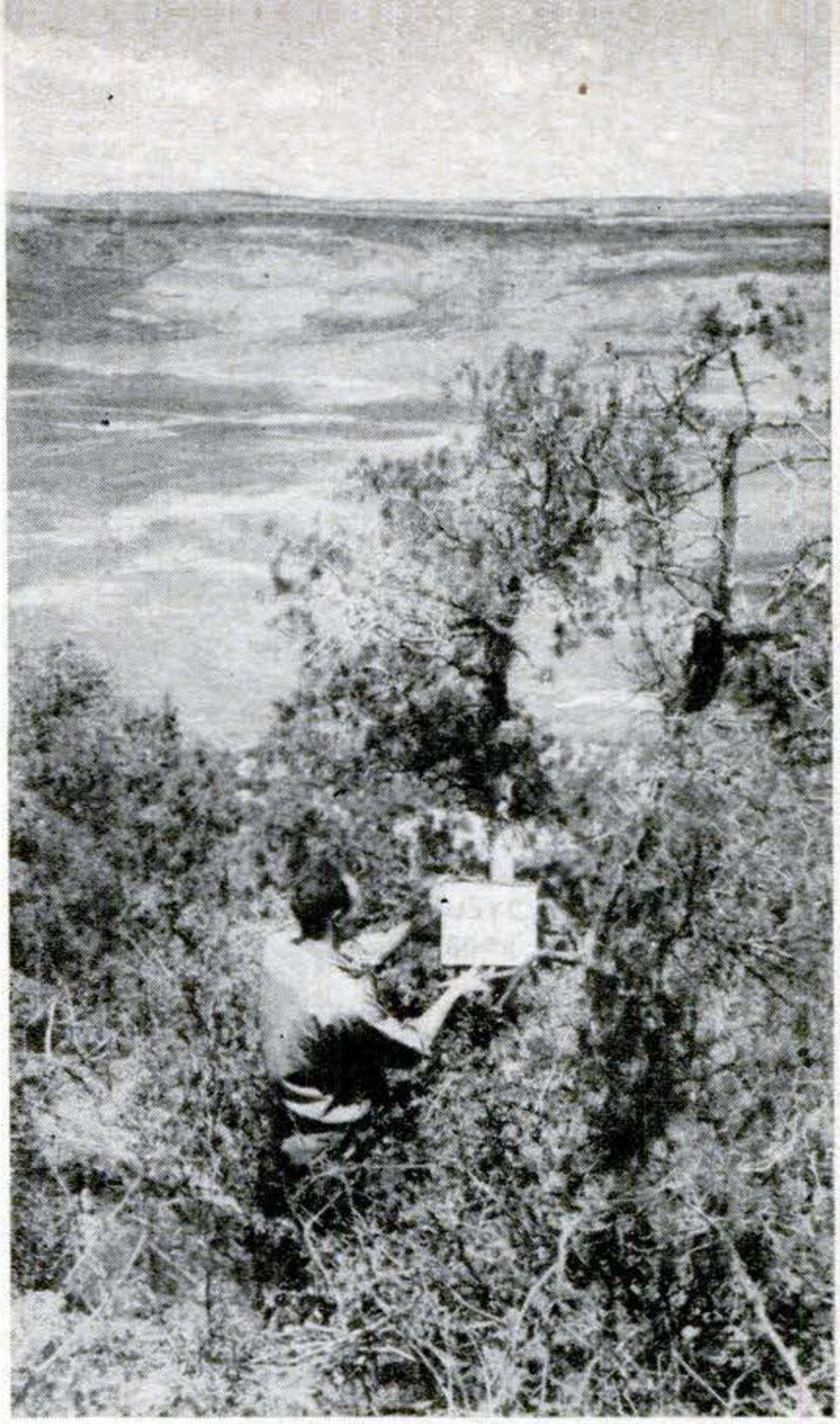
Pitchblende actually was the first uranium ore ever mined in the U.S., away back in 1871 at the Wood gold and silver mine in the Colorado Front Range. It went unrecognized and was thrown out on the dump, where a geologist found and identified it. From the following year to 1919, this and neighboring mines produced small quantities of pitchblende, perhaps 300 tons in all.

Ghost Mines Yield Again

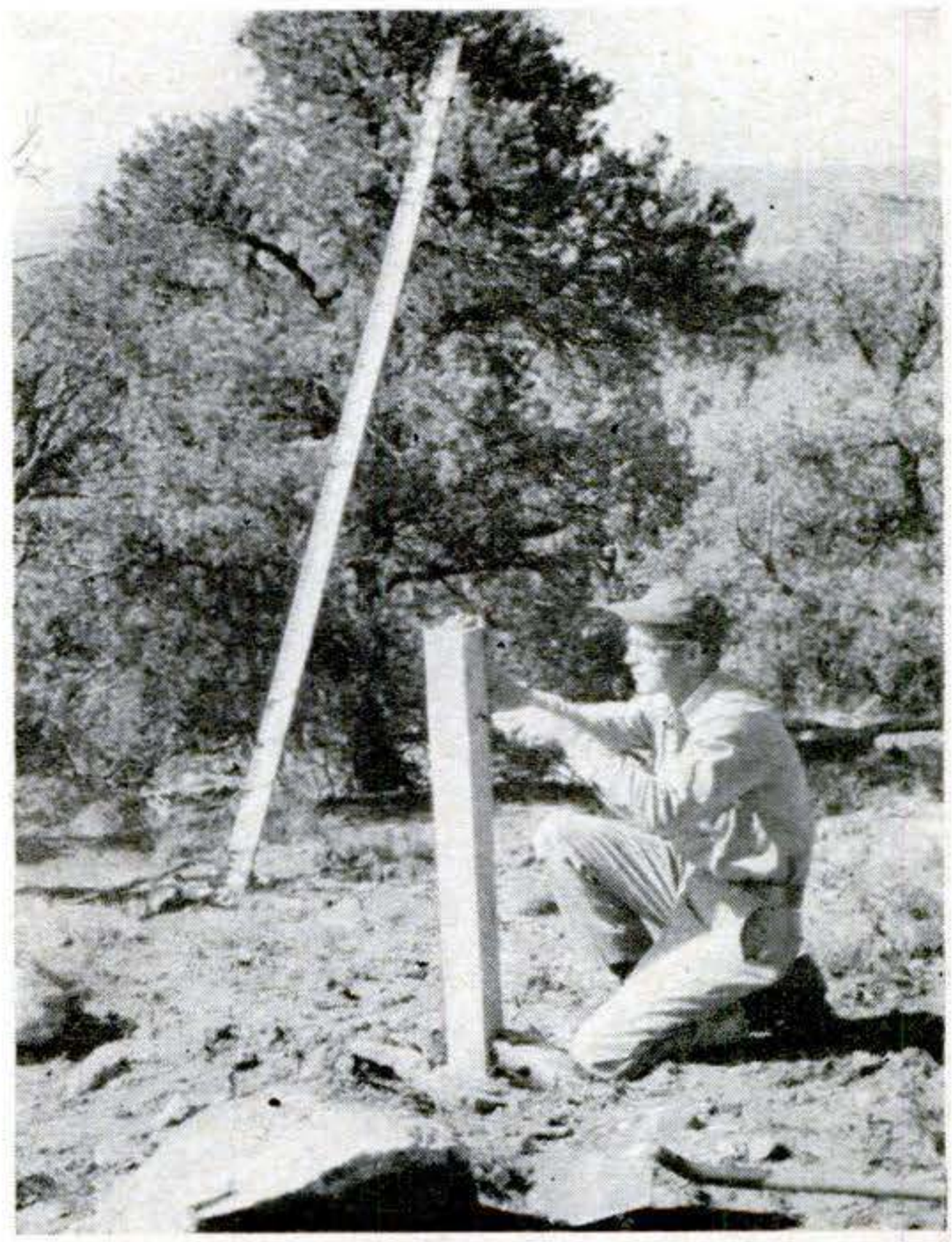
Now U.S. geologists are combing more carefully the drifts and crosscuts of long-abandoned ghost mines of the Front Range, in addition to mines still working, for pitchblende—and finding it. Their reports contain such phrases as, "Uranium occurs as pitchblende in veinlets from 1/32 to 2 in. wide."

Fantastic as it may seem to big-mine operators, pitchblende is such precious stuff that a veinlet only *one-eighth of an inch thick* can be mined at a profit.

Literally colorful is the Marysvale district in Utah, lately the most consistent producer of pitchblende from U.S. vein deposits, with most ore coming from the Prospector and Freedom mines of the Vanadium Corporation of America. Here is a large-scale counterpart, experts point out, of the rainbow-colored ores surrounding the famous Congo pitchblende veins (see color diagram on page 97). At Marysvale, in 1949, the first minable green and yellow secondary uranium minerals were discovered near the surface. Deeper probing turned up other bright-colored ones—and then, below 70 feet, brought geologists to the



THIS IS THE WAY you stake a claim for uranium. Notice posted on tree gives ownership and claim's name—here, "U.S.V.C." for U. S. Vanadium Corp., and "Brazil" for name.



AFTER SURVEY and required "discovery cut" with a bulldozer, the prospector sets up corner posts to mark his claim's boundaries. A claim covers area of 600 by 1,500 feet.

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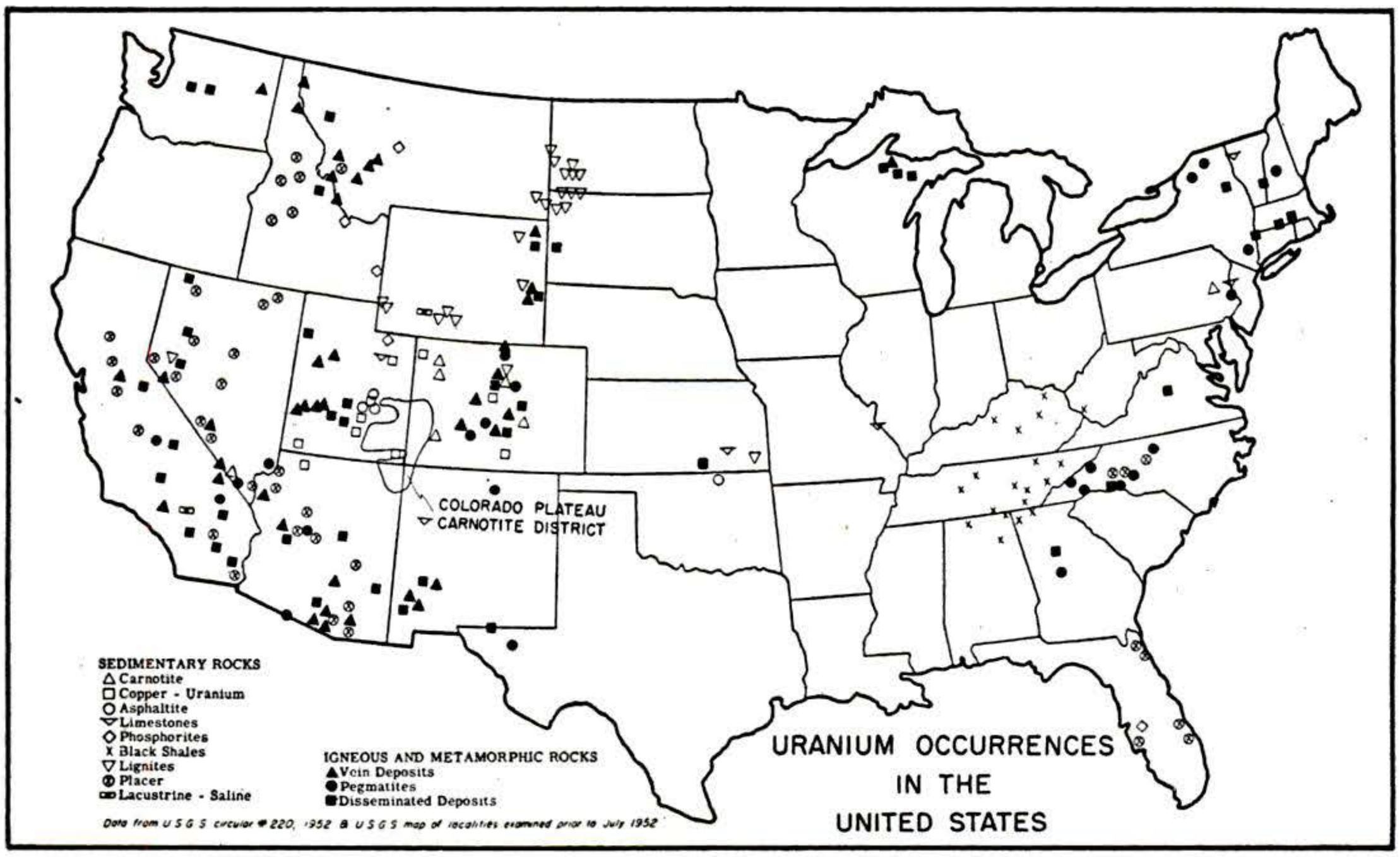
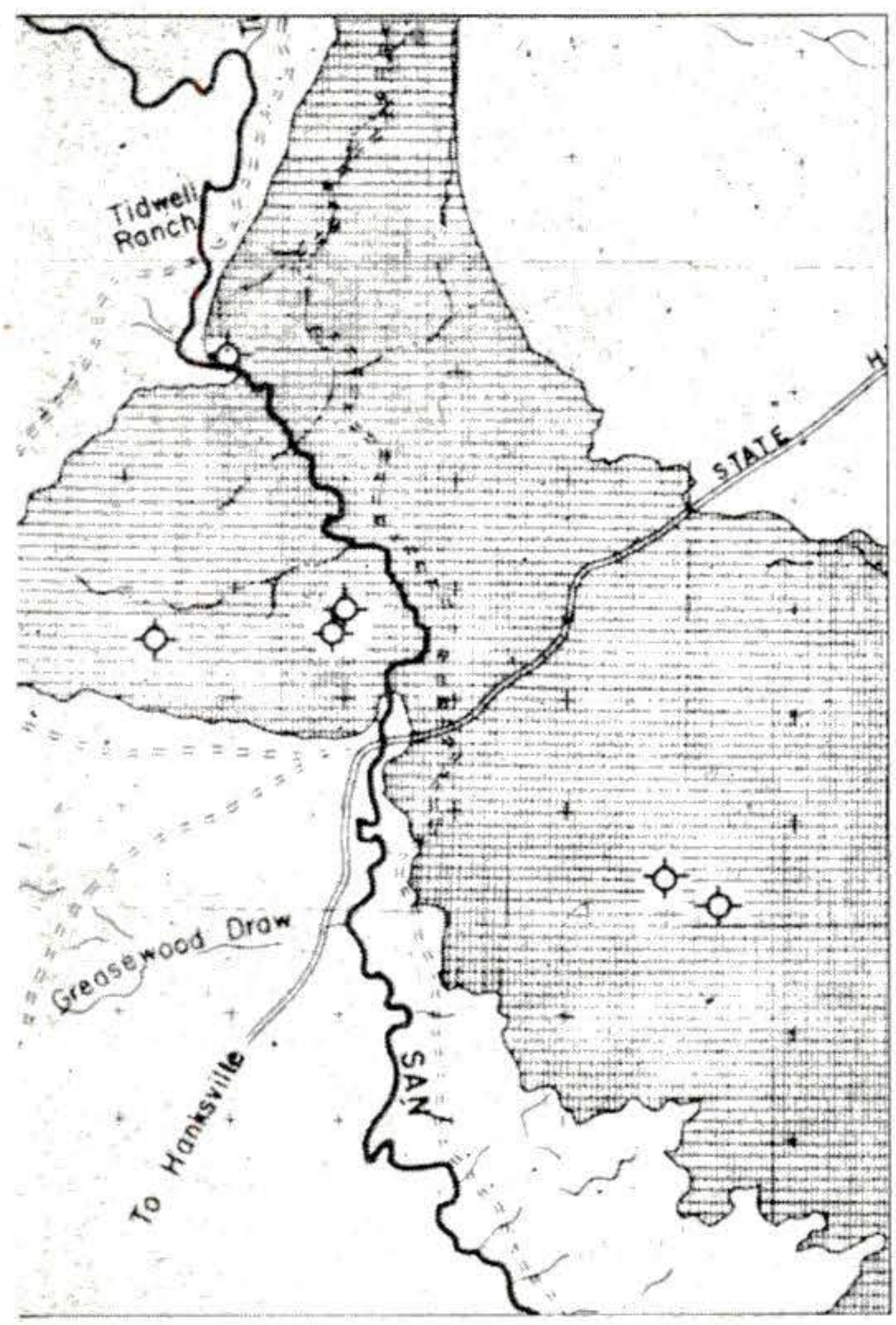


HERE'S WHERE the uranium is in U. S., by recent official AEC map. Principal source has been four-state Colorado Plateau carnotite district. Important new ones are South Dakota and New Mexico carnotite deposits, Utah and Colorado pitchblende veins and uraninite in Utah. In South, phosphate rock for fertilizer yields by-product uranium.



SIX LIKELY PLACES to find uranium in Utah are marked by four-spoked circles. Maps like this, based on aerial radioactivity surveys, are posted by AEC to aid prospectors.

pitchblende. This color pattern may prove a guide to hidden, deep-lying pitchblende elsewhere, the experts say.

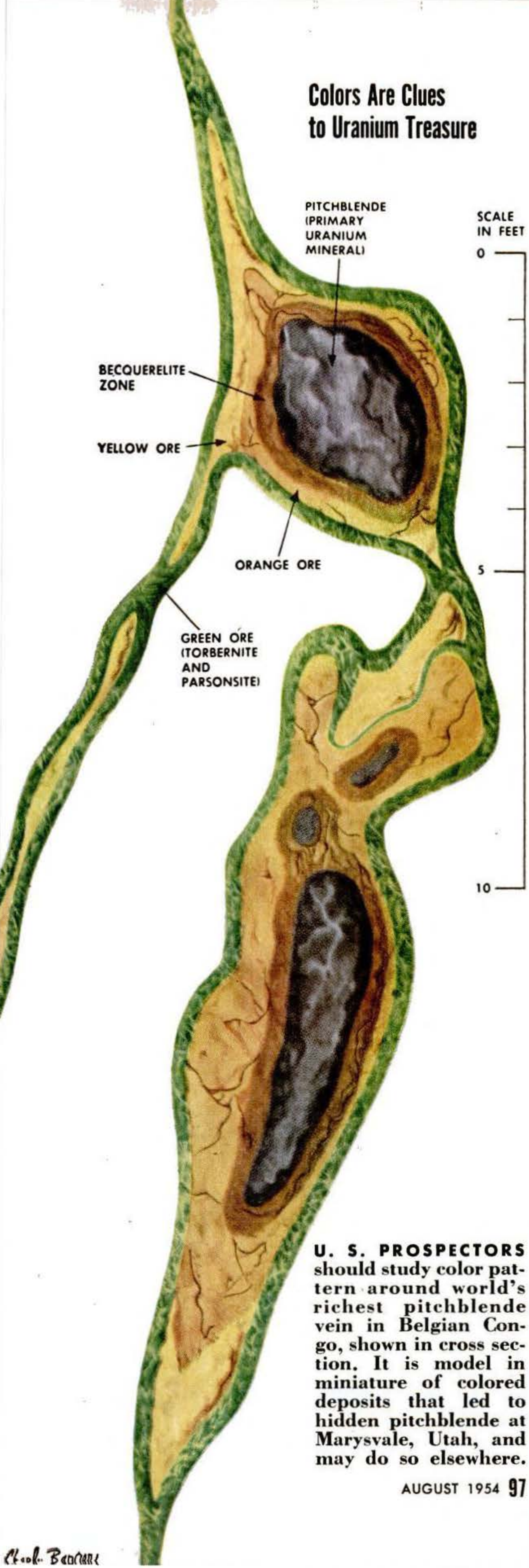
It remained for a young geologist too hard up to afford a Geiger counter, Charles A. Steen, to make the country's most sensational uranium strike. Under the broiling Utah sun southeast of Moab, one July day in 1952, he watched his rented diamond core drill bite into the rock. Then, less than halfway to his intended 200-foot depth, the rig broke. Down the hole went the lost tools and his last cent.

Automatically he gathered up the unpromising core samples of rock so far recovered, stowed them in his jeep and drove back toward town, crushed with disappointment. At a filling station on the way, Steen found a friend checking ore samples with a Geiger counter—and, though sure his own were worthless, tested them. When the counter went crazy, he knew he'd hit the jackpot.

His borehole had penetrated a 14-foot-thick bed of phenomenally high-grade uraninite ore, at 70 feet. Subsequent

[*Continued on page 240*]

Colors Are Clues to Uranium Treasure



U. S. PROSPECTORS should study color pattern around world's richest pitchblende vein in Belgian Congo, shown in cross section. It is model in miniature of colored deposits that led to hidden pitchblende at Marysvale, Utah, and may do so elsewhere.

CARNOTITE ORE in typical stockpile contains small proportion of carnotite, impregnating buff-colored sandstone. High-grade carnotite has bright yellow color (picture on cover).

AT COLORADO MILL, chemical treatment of ore extracts uranium in form of "yellow cake." Shipped in steel drums to the AEC, it will yield uranium metal for reactors and bombs.

BY-PRODUCT from same ore is vanadium, recovered here as "red cake." Miner is paid for both uranium and vanadium in his ore.

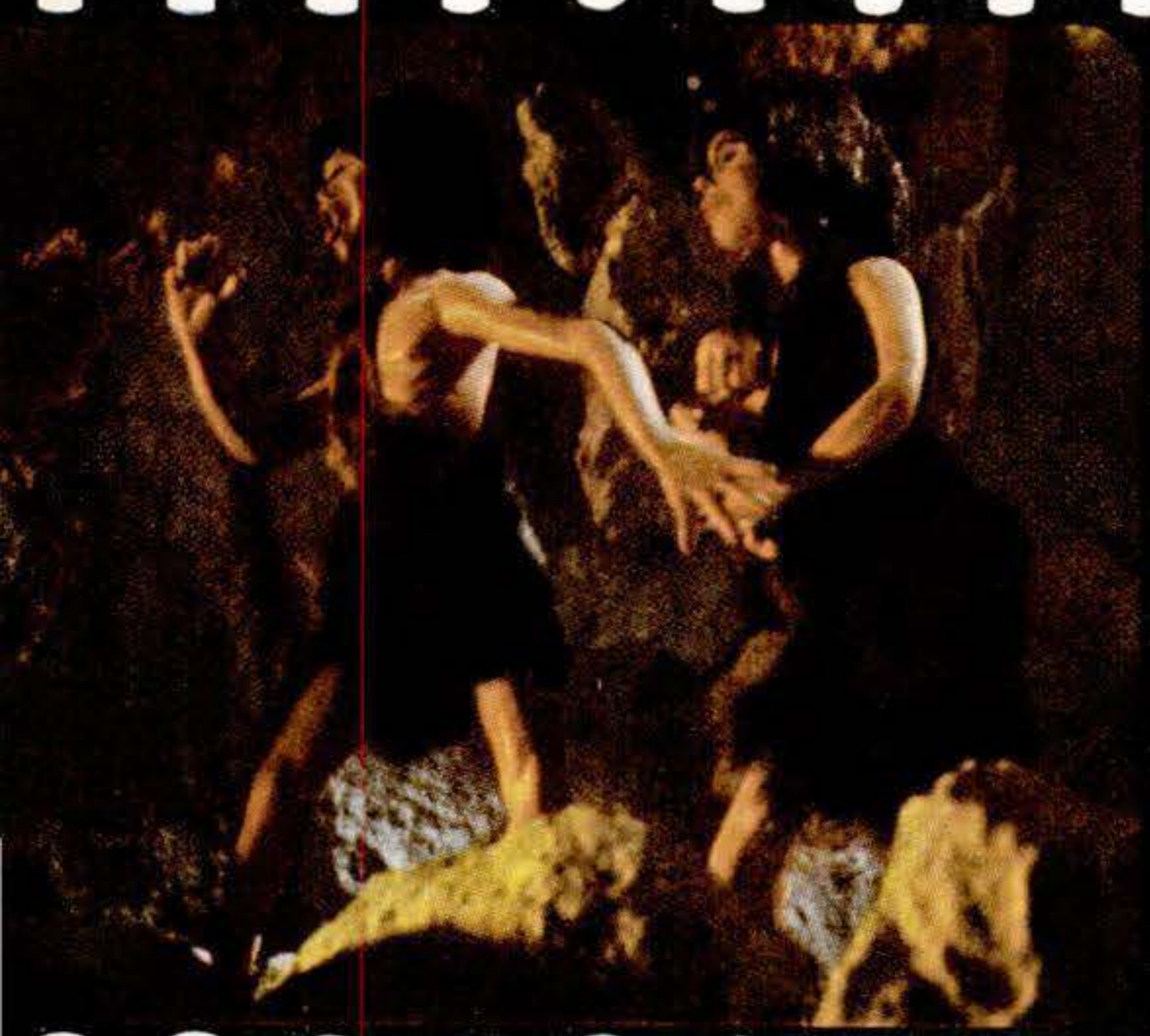
Color photos from U. S. Vanadium Company

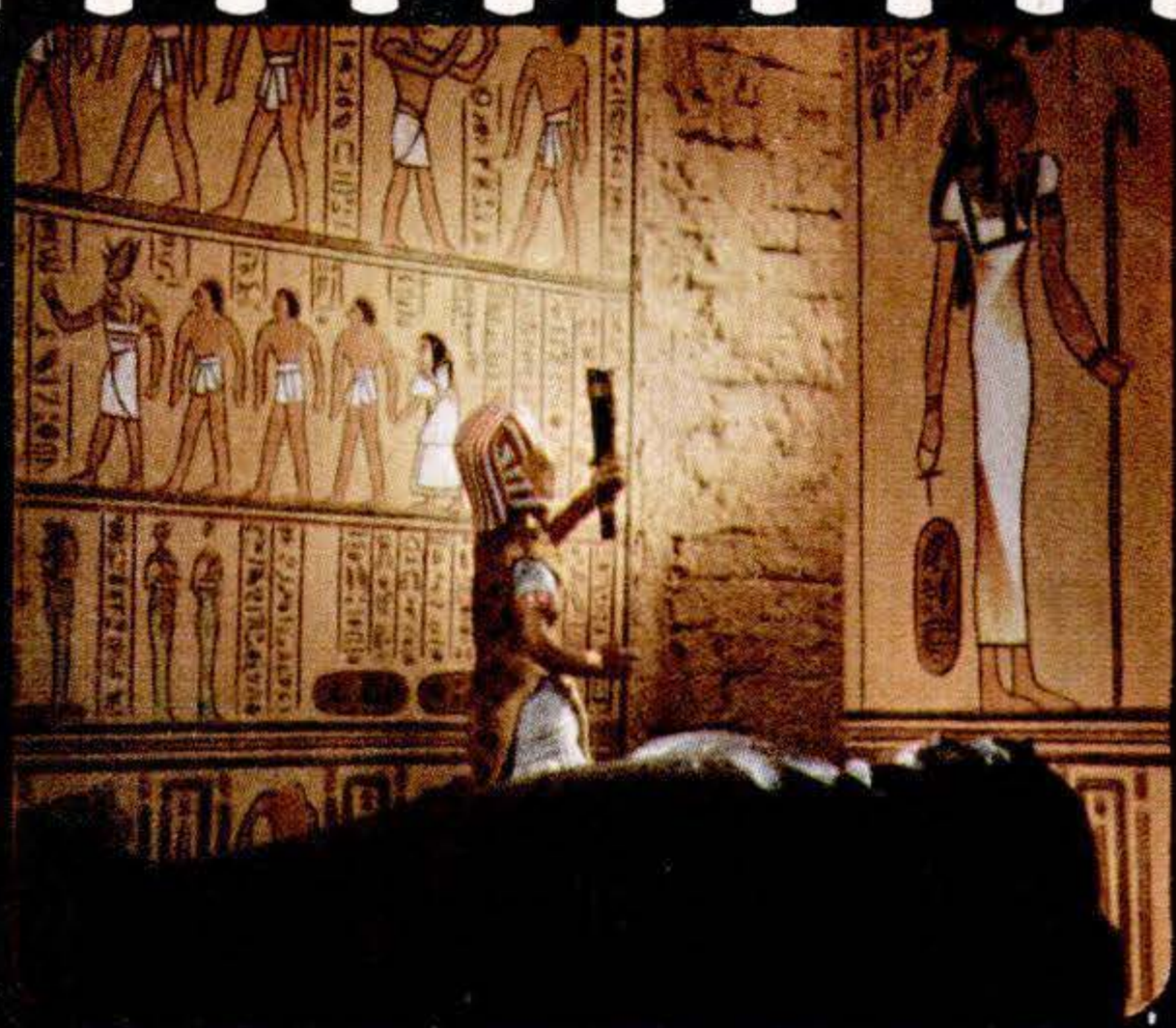
How Man Put Light to Work

A CHANGE of expression means a change of head in Dollywood, film studio of Joop Geesink in Amsterdam, Holland. There, small, lifelike puppets without strings have been making a stop-motion movie called "Light Through the Ages." The 10-minute film was created for GE to show throughout the U. S. in celebration of the 75th birthday, Oct. 21, of practical incandescent light.

Realistic dolls of plastic, wood and cloth, dressed expertly, were moved by hand and repeatedly photographed (right) as they played the scenes below.

Dutch puppets play historic scenes in stop-motion movie marking



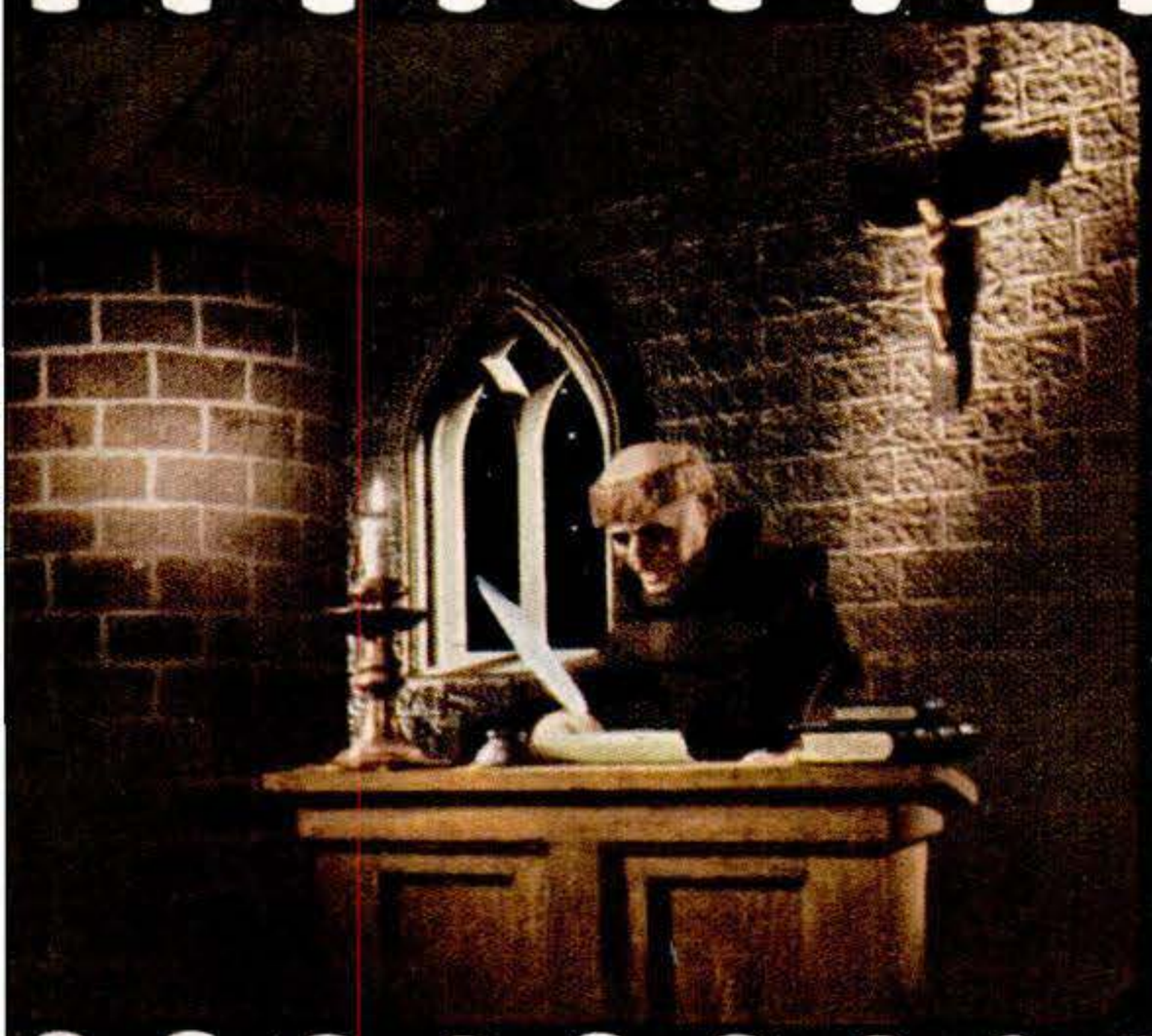


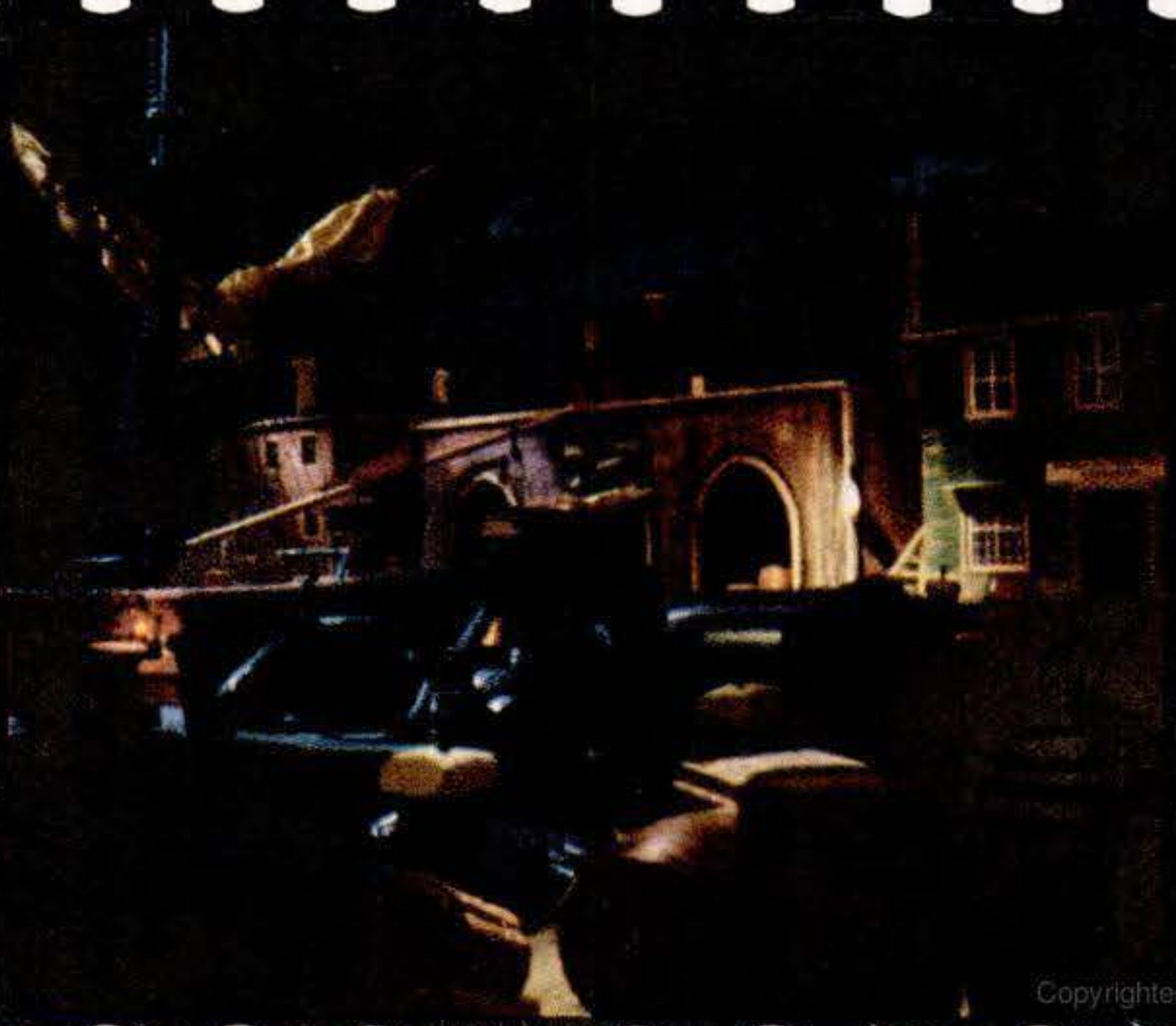
AT FIRST TERRIFIED when lightning set a tree ablaze outside his cave, early man soon learned to utilize fire to light the cave.

EGYPTIAN TORCHES consisted of flaming linen soaked with olive oil. Men burned oil for illumination for several thousand years.

TALLOW CANDLES lighted the pages on which medieval monks wrote and decorated important texts before the invention of printing.

WHALE-OIL LANTERNS illuminated the docks of young America. The discovery of petroleum in Pennsylvania in 1859 snuffed them out.





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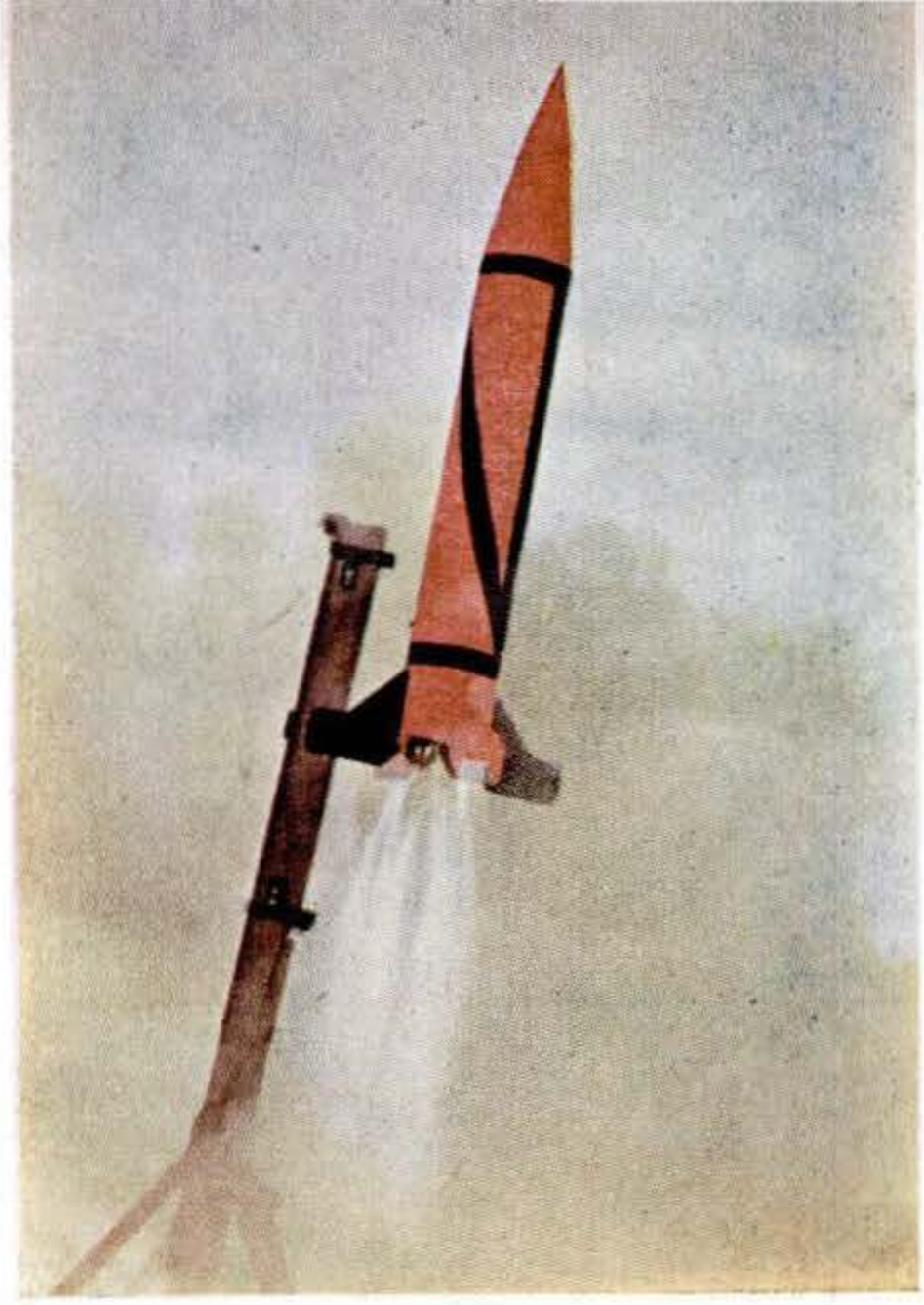
electric bulb's 75th birthday.

ROMAN LAMPS of bronze burned olive oil, too. They represented a considerable improvement in lighting fixtures, first made of stone.

YOUNG EDISON demonstrated the first successful incandescent light—carbonized cotton thread glowing in a vacuum—Oct. 21, 1879.



Heaven-Bent, a new guided missile designed and built by General Electric roars upward from its launching platform for an experimental flight at the Air Force Missile Test Center in Cape Canaveral, Fla.

First Color X-Ray, a shot of a mouse, was made by Dr. Ralph S. Mackay, University of California. He took three X-ray pictures at varying wave lengths. then projected them through three different color filters.

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The Truth About Your

"You may go thousands of miles without a crash stop—then the chips are down."

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Brakes

Can you count on them? Are they keeping up with power? What's Detroit doing about it?

By Frank Rowsome Jr.

ENERGY-ABSORBING gadgets like auto brakes do not have the glamour of energy-producing gadgets like engines, but they are fully as important; running out of brakes tends to be more exciting than running out of gas.

"Accidents due to defective brakes," the Association of Casualty and Surety Companies reports, "have contributed to more than 40 percent of all mechanical-defect accidents." Insufficient or inferior fluid, worn linings, and worn master or wheel cylinders are the chief culprits.

But sudden, total brake failure is actually quite rare. Far more common is a gradual deterioration of stopping performance, built up over thousands of miles. Since it comes imperceptibly, it can sneak up on a driver: on a hard stop the pedal will come nearer the floor, but only a *little* nearer than it did last month.

A complicating factor is that expert drivers can be trapped by their own competency. With a combination of skill and good judgment, you may go thousands of miles without a crash stop—then, suddenly, the chips are down. That's a bad time to discover worn brakes.

What is Detroit doing about it?

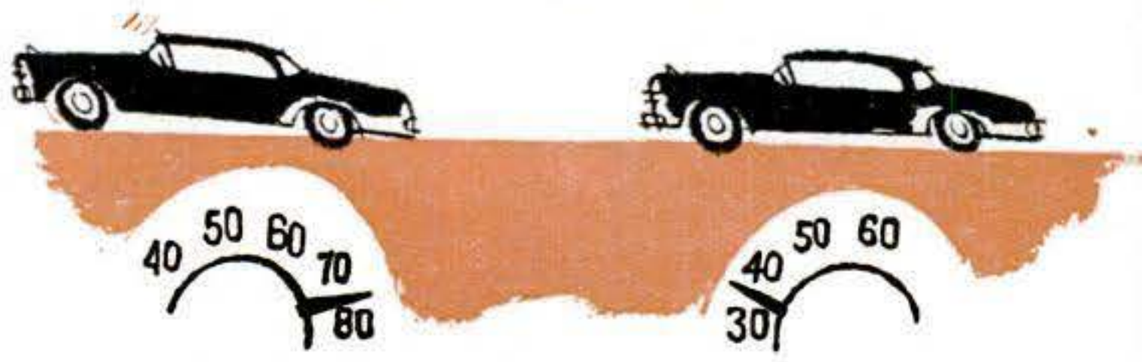
Even though brake engineers have enough glittering equipment and Greek-letter mathematics to split an atom, brake work is largely done on a let's-try-it-and-see basis. Brake design is intricate, and a theoretical approach is hampered by technical mysteries (what *is* friction anyhow?) on which experts disagree.

There is also general Detroit agreement that you don't fool around with brakes. Styling spears, power-operated

How to Use Brakes

USE BRAKES SPARINGLY. Unnecessarily hard or frequent braking not only wastes gas, tires and brakes, but it adds to fatigue and is the mark of an unpolished driver.

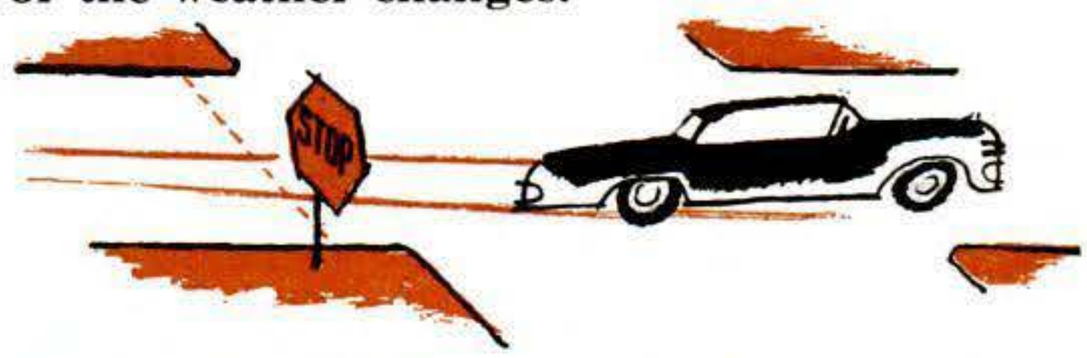
PUMPING OR FANNING THE PEDAL (a rapid on-off movement) can help with directional control on a slippery surface, or when a pedal goes dangerously low.



IN A STOP FROM HIGH SPEEDS, it is preferable to build up the *rate* of deceleration as quickly as comfort permits, doing most braking while still traveling fast.

IF TRAPPED BY A TIGHT TURN, try to stay off the brake pedal. If the turn is going to make tire-to-road adhesion chancy, you can't afford to spend adhesion in braking.

MAKE A PRACTICE of using the brake pedal to test for possible slipperiness when you come to a different kind of road surface, or the weather changes.



GUARD AGAINST the tendency to grow so accustomed to your car's brakes that you allow them to become badly worn.

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Brakes gulp energy even faster than today's engines produce it

CLIMB INTO A ZIPPY 1954 SEDAN, select a deserted stretch of highway, and belt the gas pedal. When you get up to 75 m.p.h., hit the brakes hard—just shy of a squawling crash stop. You'll get back to zero fast. Where it took a 200-plus-hp. engine 20 seconds and 1,300 feet to accelerate you, the brakes do the opposite in less than five seconds and 275 feet. The energy they soak up then amounts to *500 or 550 horsepower*.

antennas, and even the seductive curves of your combustion chamber can be left for the brass and the sloganeers to tinker with. But nobody ever bucks for anything but the best possible brakes that the budget can provide.

What are the problems? A brake designer, in theory, can count on six inches or more of pedal travel and a peak pedal pressure of about 150 pounds. (Even Grandma, using her elderly knee as a kind of toggle, can push that hard.) But the competitive heat is on the brake designer to lighten the job. So he specifies a brake-shoe linkage that has a servo effect—one that uses a "wrapping" shoe that borrows energy from the car's momentum to do part of the work.

This is fine—a kind of poor man's power brake—but it brings its own headaches. One is the need to equalize wear among brake shoes; another is that brakes must obviously also stop a car from rolling backward; a third is that if you get *too* much self-actuation, the brakes may accidentally lock. A continuing problem with self-energizing brakes—which most U.S. cars now use—is that the more "servo" you put in, the less constant it is.

But constancy is *the* prime brake virtue. To be truly safe, a brake should deliver a predictable, proportional response despite wide variations in speed, load, temperature, humidity, frequency of applications and a host of other variables. (You can see why the pros usually refer to a brake as "she" and use the term "morning sickness" to describe one common ailment. This is the snappish habit otherwise docile brakes have of pitching you on your snoot the first time you touch the pedal in the morning—a matter of moisture condensing inside and upsetting servo calculations.)

The harried designer has a packet of other problems. Where's he going to dispose of brake torque, a gigantic twisting force that, on a hard stop, wants to pretzel the suspension? What about forward weight transfer, which tries to nose-dive a fast-stopping car? How can he best divide up the work between front and rear brakes when a car will have enormous variations in load distribution?

At proving grounds and technical centers, they say:

- *Brakes are not, on performance, lagging behind engines. They have had an increasingly mean job: heavier cars, higher average speeds, transmissions affording less engine braking. But they are holding their own. Stopping performance is demonstrably better than before the war.*
- *Power brakes are here to stay, having outlasted some sharp behind-the-scenes controversy.*
- *Disk brakes, although under study by many makers, are apparently not going to supplant drums in the near future. The best of them work well but they are too expensive.*
- *The fade problem—progressive failure of brakes during severe use—is being assailed from several directions, including special cooling and linings.*
- *Brake governors—clever little gadgets that unlock a sliding wheel to reduce swerve in crash stops—are being studied.*

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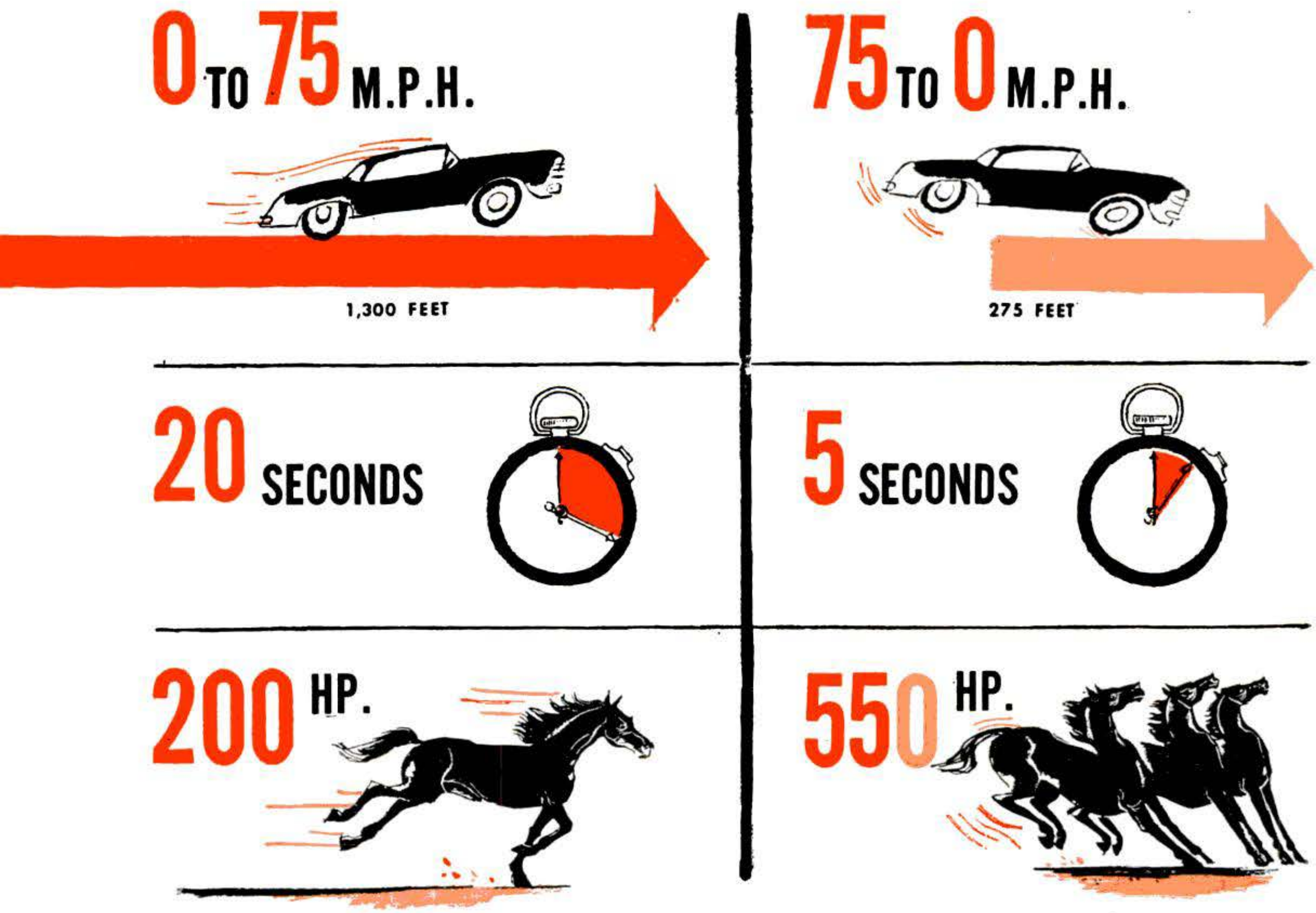

How's he going to get big, cool-running drums with small tire diameters? (Bigger drums wouldn't be an unalloyed blessing: more area and more leverage, at the cost of higher surface speeds and more unsprung weight.) And how's he going to design a hydraulic system that will withstand 1,500 pounds to the square inch, last indefinitely, never fail suddenly, and cost less than the competition's?

They love power. Brake engineers as well as lady drivers like power brakes; there's less need to sweat for a soft pedal, and tougher linings can be specified. They don't stop a car any faster, of course, but they make it *easier* to produce any given deceleration.

Standard equipment on some '54 cars and comparatively low-priced options on all others, modern power brakes are vacuum-operated boosters that multiply pedal input by three or more. A good deal of ingenuity has been spent in providing reactive feel, vacuum storage, and "fail-safe" performance.

Low-pedal power brakes—with total travel about that of the accelerator—let a driver swivel his foot on the heel between brake and gas. This is quick and easy, but also has provoked a sharp undercover fight on safety. Reducing pedal travel reduces leverage produced by the driver's foot, which is all right as long as boost is available.

Say the high-pedal advocates (notably the four Chrysler divisions): An engine killed at less than 20 m.p.h. on a winding downgrade may not be momentum-started through an automatic or overdrive transmission. An inattentive driver —let's call her a dopey dame—may not know it, and may use up the vacuum reserve unconsciously. Then a sudden emergency, on a low-pedal car, may call for immensely high pedal pressures.

That there is some cogency to the point is suggested by Olds' use this year of a bigger vacuum tank, and by Buick's new optional electric vacuum pump. This writer has tried out both high- and low-pedal jobs with engine cut and vacuum reserve expended. In the high, effort is only a bit more than with unboosted brakes. On low-pedal cars you have to

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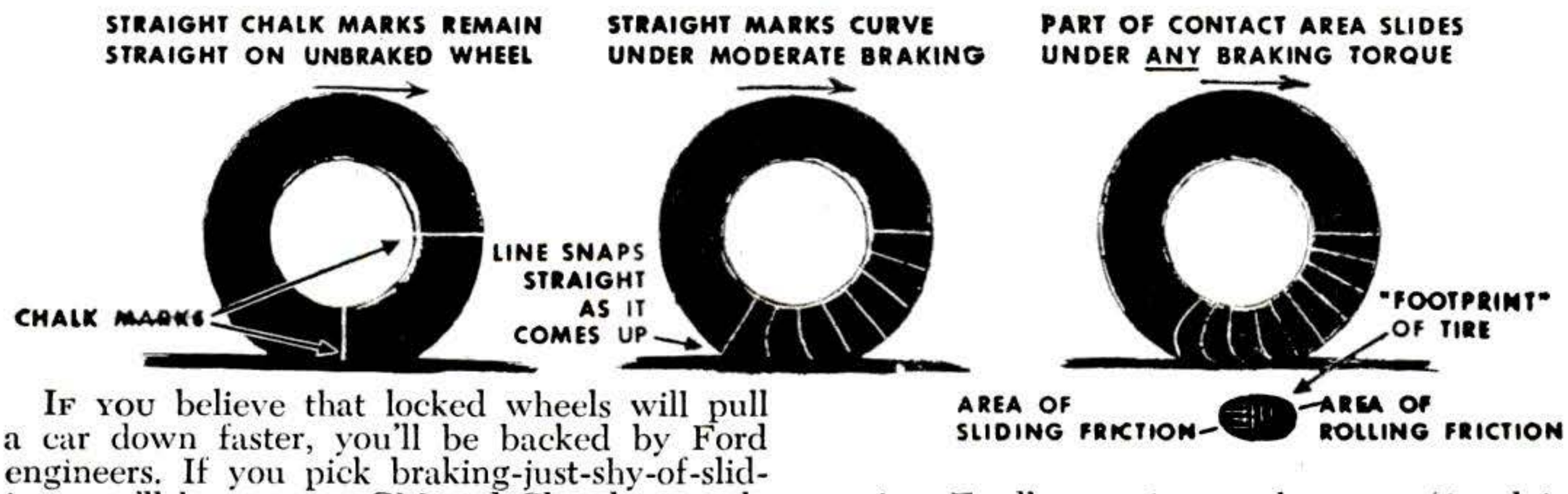
What's the Quickest Way to Stop Your Car?



If you believe that locked wheels will pull a car down faster, you'll be backed by Ford engineers. If you pick braking-just-shy-of-sliding, you'll have many GM and Chrysler people in your camp.

Most automobile people have long cherished the notion that maximum braking comes when a wheel isn't quite dragged, maximum acceleration when it isn't quite spun. It is a plausible notion. Ford's experiments, however (involving static friction coefficients, torque and other factors), suggest that it isn't true.

However the experts resolve the dispute, it is plainly an excellent idea not to rely on sliding wheels to stop you.

tromp very hard indeed. Startlement is perhaps a big factor, which suggests the merit of running an occasional rehearsal.

Those wonderful disks. Prophets have long been hailing disk brakes as the coming thing. They do a fine job on heavy aircraft, have been widely touted as a major reason in Jaguar sports-car victories, and have done well on the heaviest Chryslers.

Disks—which work by pinching pressure on a disk turning in the same plane as the wheel—have big advantages. Unlike a drum, a disk won't distort under pressure. It won't expand with heat in a direction that reduces useful pedal travel. Counting both sides, it has a bigger "swept" area than a drum. And open, racing-type disks are about as perfectly ventilated as a brake can be.

The drawbacks are also considerable. If you expose the disks to grit and rain, you'll shortly get pitting and roughening of the disk surface, which is murder on lining life. (Car brakes, unlike racing jobs, must go thousands of miles without attention.) But if you enclose the disk in a housing, as Chrysler does, you go back to building ovens—enclosed containers with heat sources inside.

Moreover, by the time you get a disk brake smooth, self-adjusting, self-actuating, and all the rest, you end up with an intricate, costly mechanism.

Anatomy of fade. A brake is an energy converter that trades foot-pounds for calories. When you overfeed it energy, it produces too many calories, which generally means fade trouble. Fade is the alarming loss of stopping power that can occur when you hit the pedal hard and often, say, down a long mountain grade.

There's a distinction between pure fade and "loss of pedal." The latter, when your foot goes smack to the floor, may come from low fluid, wear, or drum expansion; but unless there is actual hydraulic failure, you can correct for it in a pinch by pumping the pedal back up. True fade is different: a heat-caused change in the coefficient of friction between lining and drum. You push like all get-out, and the pedal still has travel left, but you don't do much stopping.

The experts aren't sure how it happens. Some talk obscurely about monomolecular behavior. Others theorize that oily liquids used as a binder in linings come boiling onto the surface under intense heat. There's no question that extremely fade-resistant linings can be made; the difficulty is that you have to pay elsewhere in things like loss of smoothness, higher unit pressures, or a tendency to score drums.

The other avenue of attack is through cooling. This includes such measures as the electric blowers on the rear brakes of the Mexican-race Lincolns.

[*Continued on page 232*]

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THEIR GOAL WAS IN SIGHT when Louisville's amateur astronomers reached this stage of the 20-year project. It consisted of making a wooden pattern for the cell that would hold their 20-inch mirror. Here was work at which those who had no talent for grinding mirrors could show their skill.

Big-Time Telescope Built in Basement

Amateur stargazers in Kentucky worked 20 years at their hobby.

THE biggest telescope in Kentucky is homemade. It cost less than $1,000 to build and house. That makes it just about the least expensive big telescope in the world—in terms of money. In terms of effort, the story is quite different. It took 20 years of

A SLIT IN THE DOME, actually a silo top whose peak was 14 feet above ground, was given a covering driven by motor.

THIS 20-INCH PYREX DISK became the telescope's mirror when it finally had been ground, polished and plated with a half-ounce of silver. The three-inch hole in its center allows star reflections to come back through the mirror and into the eyepiece.

planning and fussy work, including 4,000 hours of glass grinding in a basement, to get the 20-incher ready to sweep the heavens.

You'll hear no complaints, though, from the mathematics professor, gas chemist, bridge engineer, machinery inspector, retired manufacturer, electrician, draftsman and machinist who did most of this work. After two decades of anticipation, each one of them, as a member of the Louisville Astronomical Society, now happily owns a key to an observatory that he helped to build. There he can climb a six-foot ladder and gaze through an eight-foot tube at Venus or Mars or any other celestial resident to his heart's content.

Once the project, years ago, had progressed beyond the talking stage, the amateur group moved blithely into professional circles. They ordered a mirror from the Corning Glass Works, whose engineers had just poured and annealed

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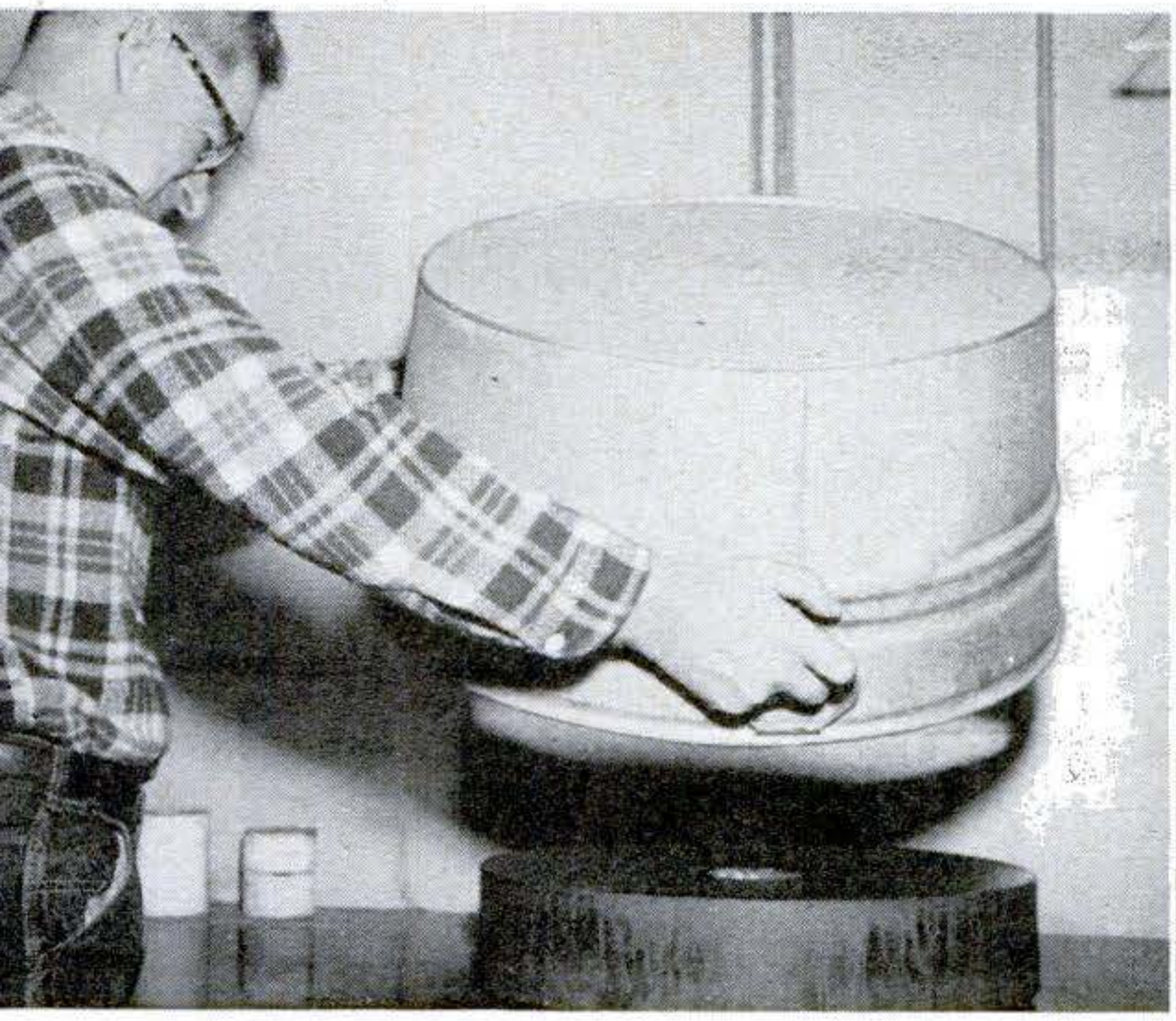
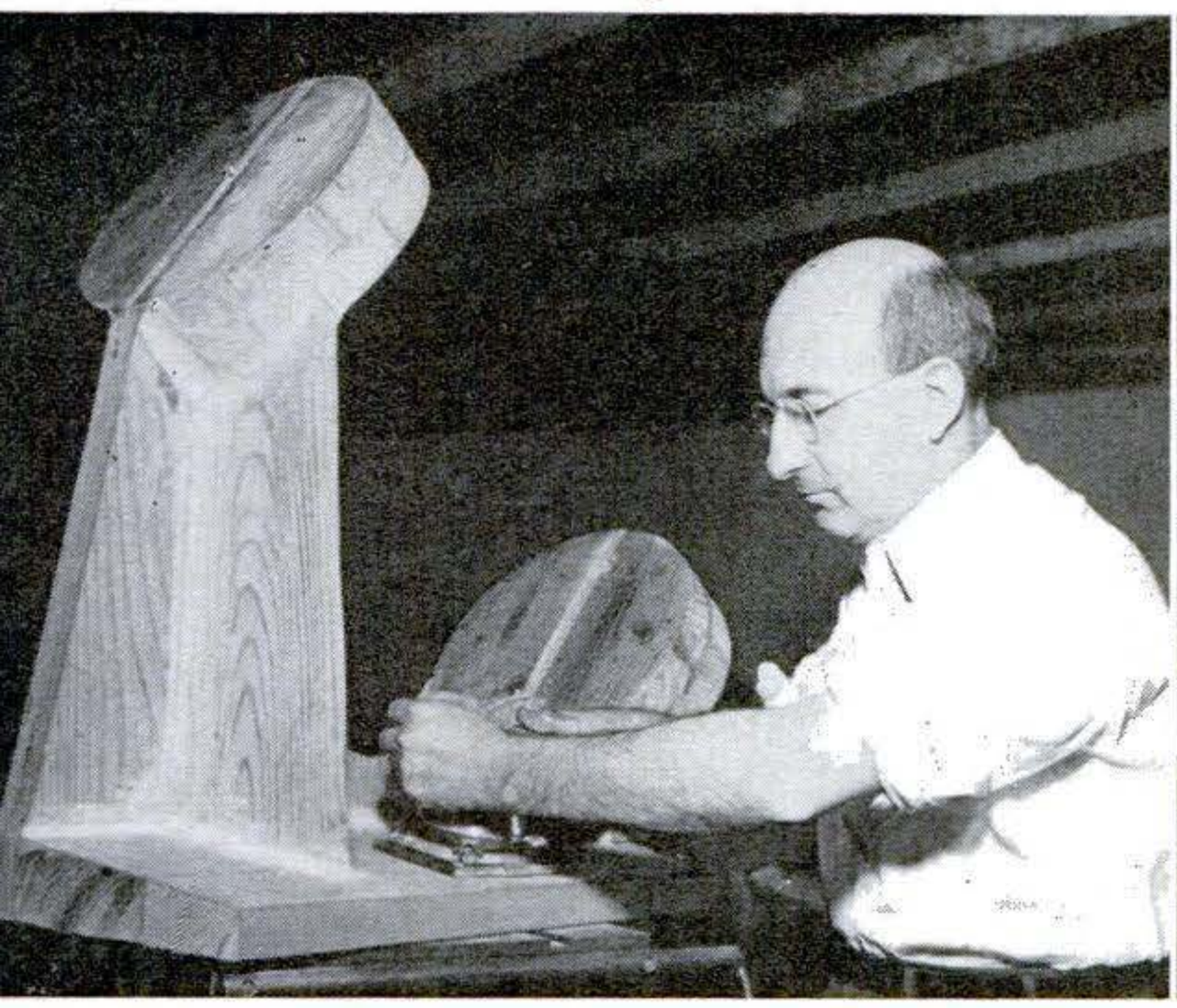
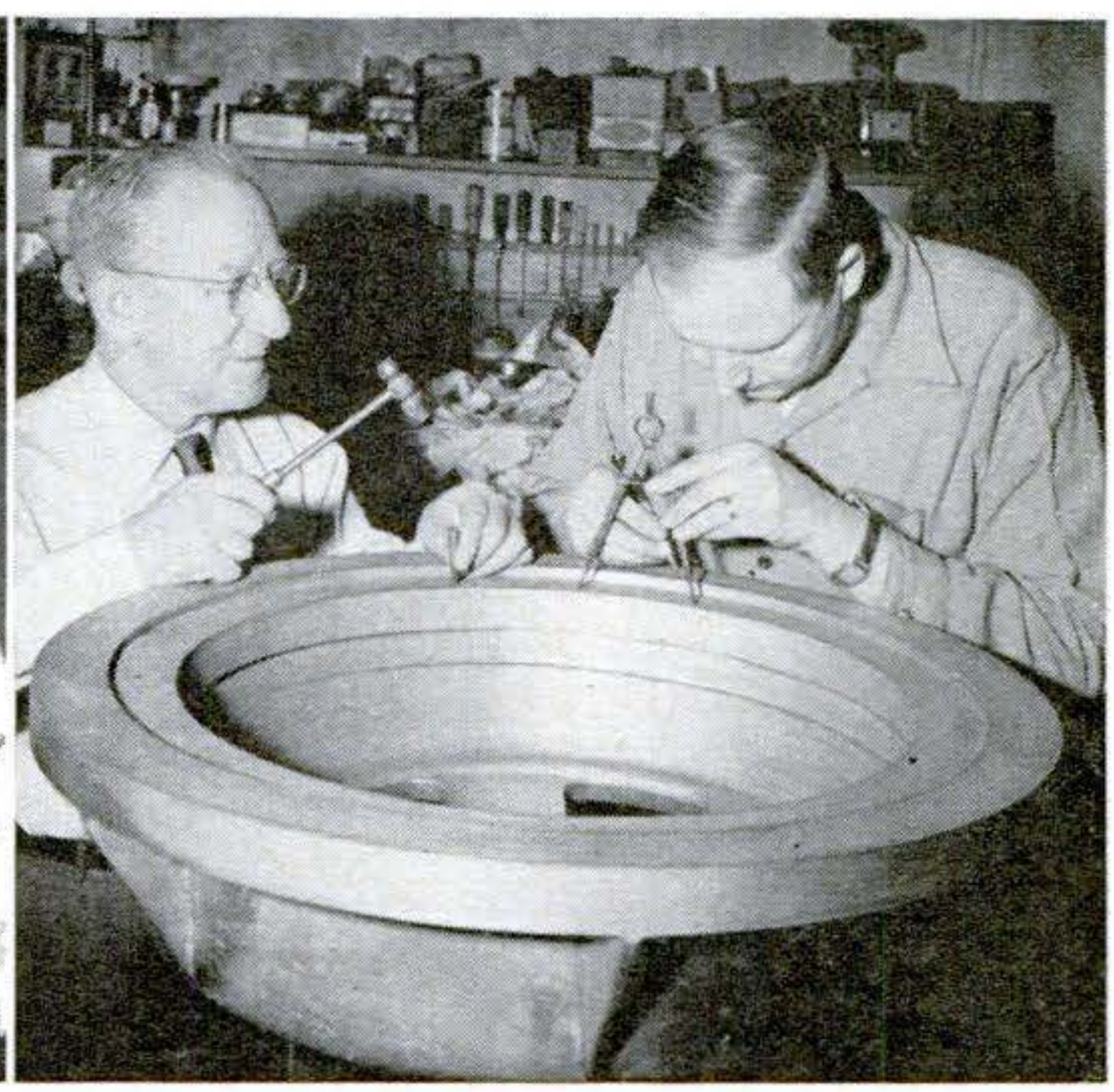


AN OLD WASHTUB in Dr. Walter L. Moore's basement workshop protected the delicate mirror from dirt between grinding sessions.

FINISHING A MODEL for a cast-aluminum ring, one of those required to mount the amateurs' telescope, which is of the open-tube type.



THE MAIN SUPPORT of the telescope followed this pattern, shown as it was being assembled by an Astronomical Society craftsman.



FRAME FOR A 20-INCH MIRROR, the cast-aluminum cell above was carefully measured and marked before being drilled for mounting.

the giant 200-inch mirror for the Mt. Palomar telescope in California. The 20-inch, 110-pound disk that they got for their money—only $84.79—was poured according to the same formula as its 200-inch cousin.

When the mirror arrived, marks of the brick mold were still on it. The rough edges had to come off, and that started the years-long, piecemeal ordeal of grinding and polishing.

"We could have finished the job a lot sooner if we had been better opticians," says Louis Aker, one of the group. "Three different times our mirror grinders found that they had ground hollows in the disk and had to start all over again."

When the mirror was ready, the amateur stargazers went to work on the observatory, a structure 17 feet in diameter, made of concrete blocks. Its aluminum dome, originally intended to top a silo, was fitted with rollers and a track in order to revolve.—*George Laycock.*

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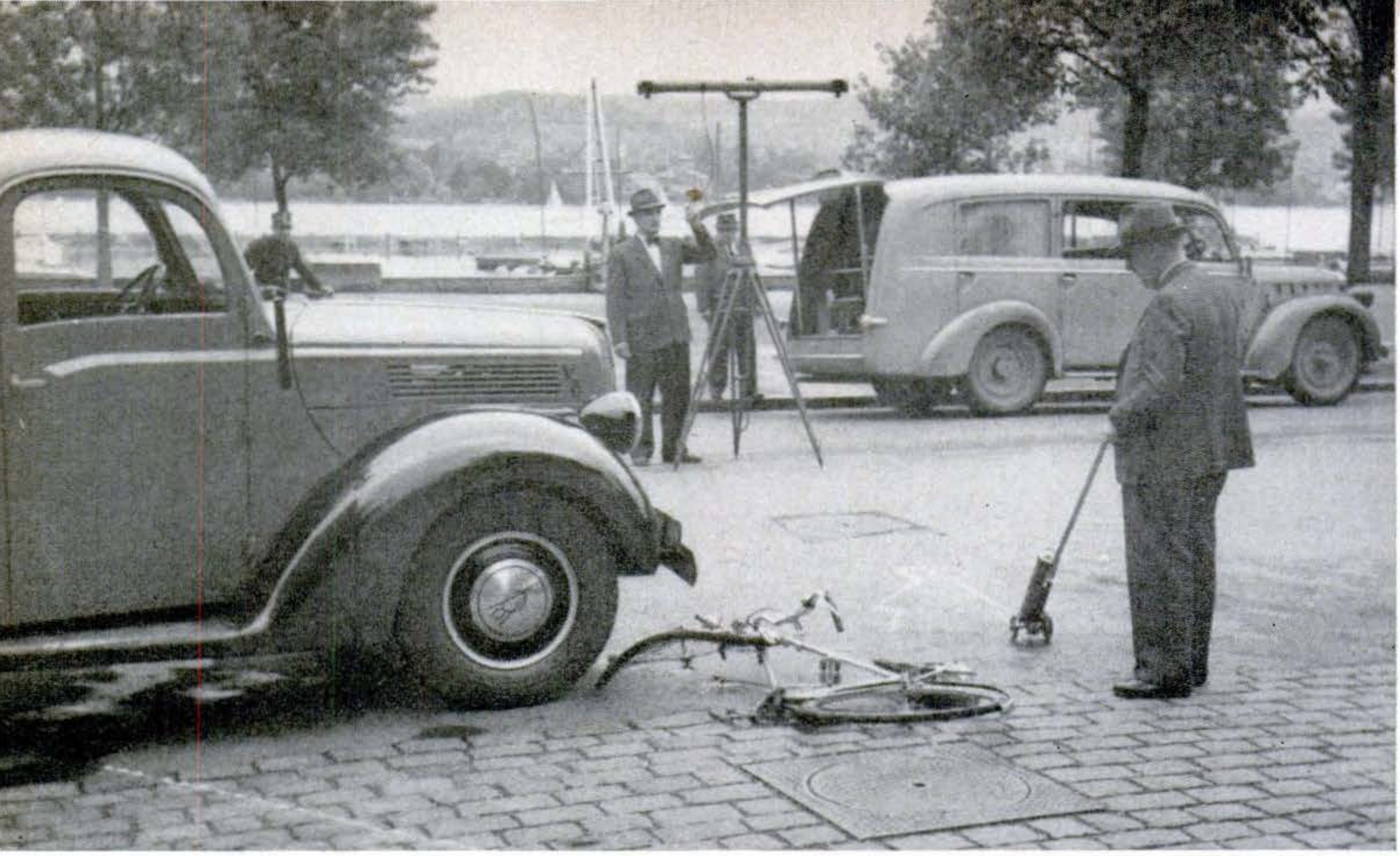
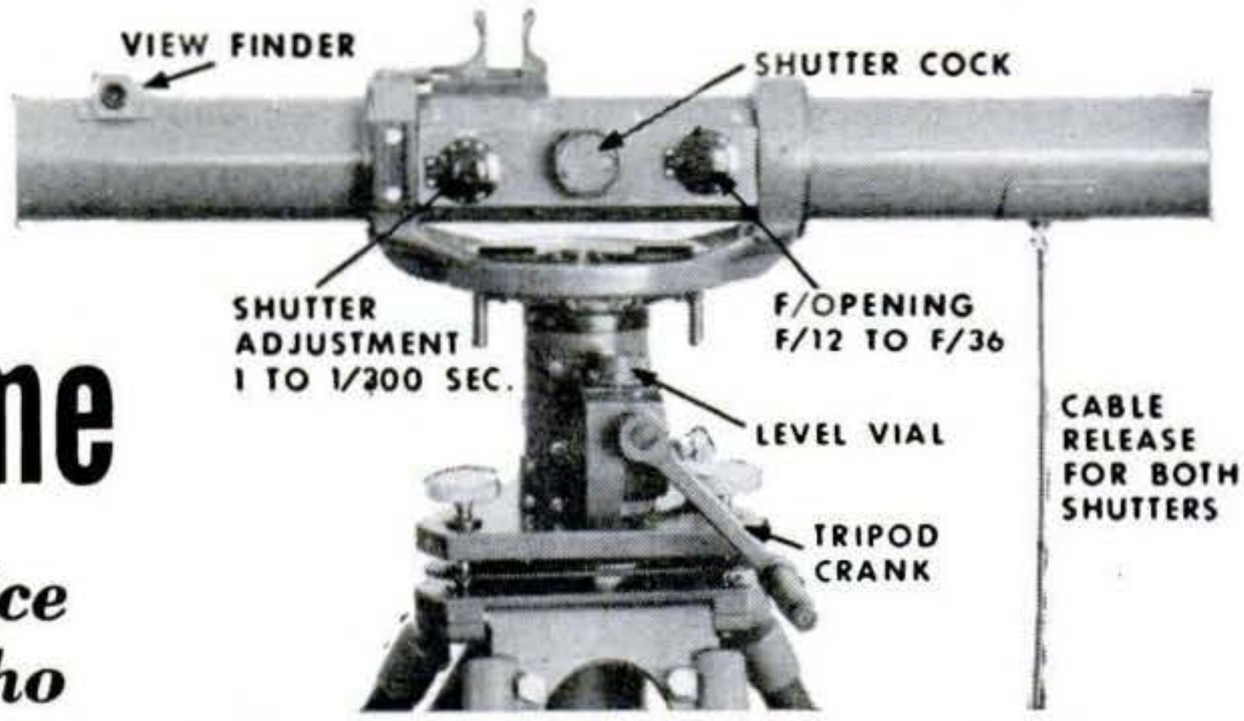


Police of Bern, Switzerland, take 3-D photos to settle dispute in auto-bicycle accident.

3-D Photos Fix Accident Blame

Camera eyes carried in police cars help tell the judge who was at fault in a traffic crash.



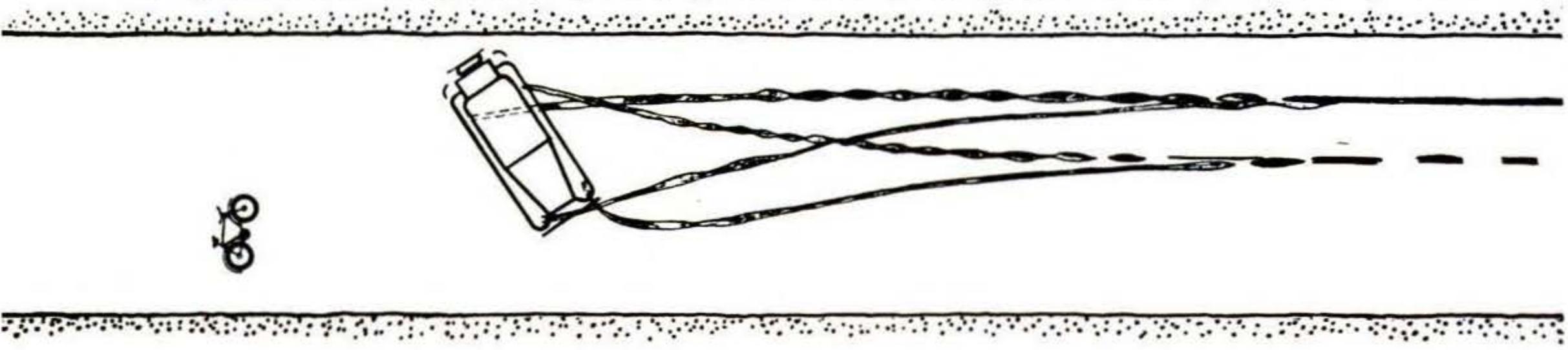
Controls of 3-D camera are on a tubular bar.

IN SWITZERLAND they don't argue about who was responsible in a traffic accident. That's because Swiss police cars carry a witness that can't lie or forget—a special camera that takes 3-D photos for judge and jury to see in case of a dispute.

Viewed through an inexpensive stereoscope, enlarged photographs give indisputable evidence of what happened. From the pictures, the police can plot the accident scene on maps that give such information as width and incline of roadway, skid marks, distance and direction of travel before and after the impact.

The camera, made by the Wild Survey Instrument Co., has two lenses (really two complete cameras) mounted about four feet apart on a rigid tubular bar to give exaggerated stereo views. The device is mounted on a tripod with a head that can be leveled like a transit. When the scene of the accident has been centered through a view finder, the bar is raised on the tripod to take pictures from an unobstructed height.

Diagram below was plotted by Swiss police from photographs taken by stereoscopic camera.



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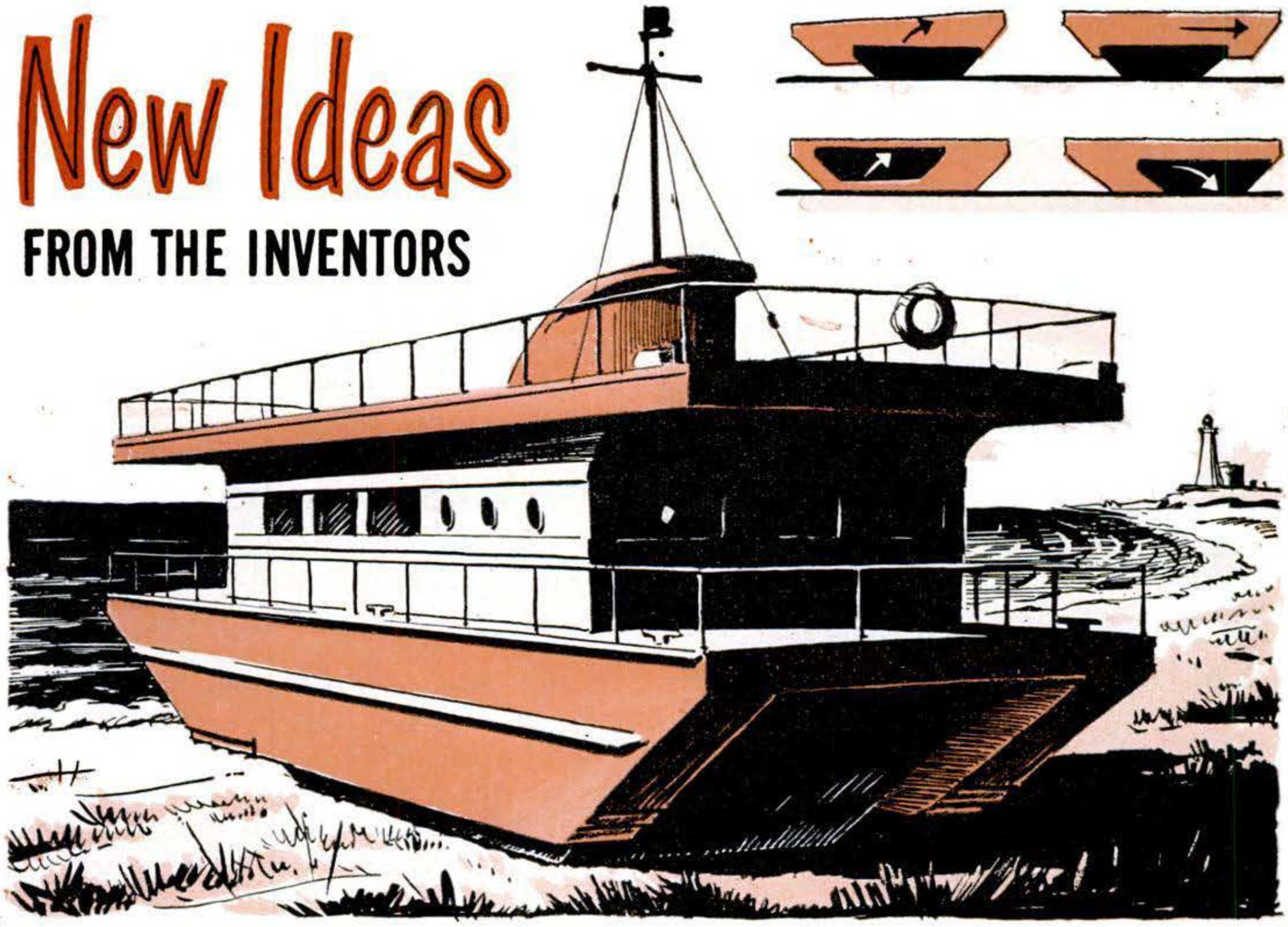
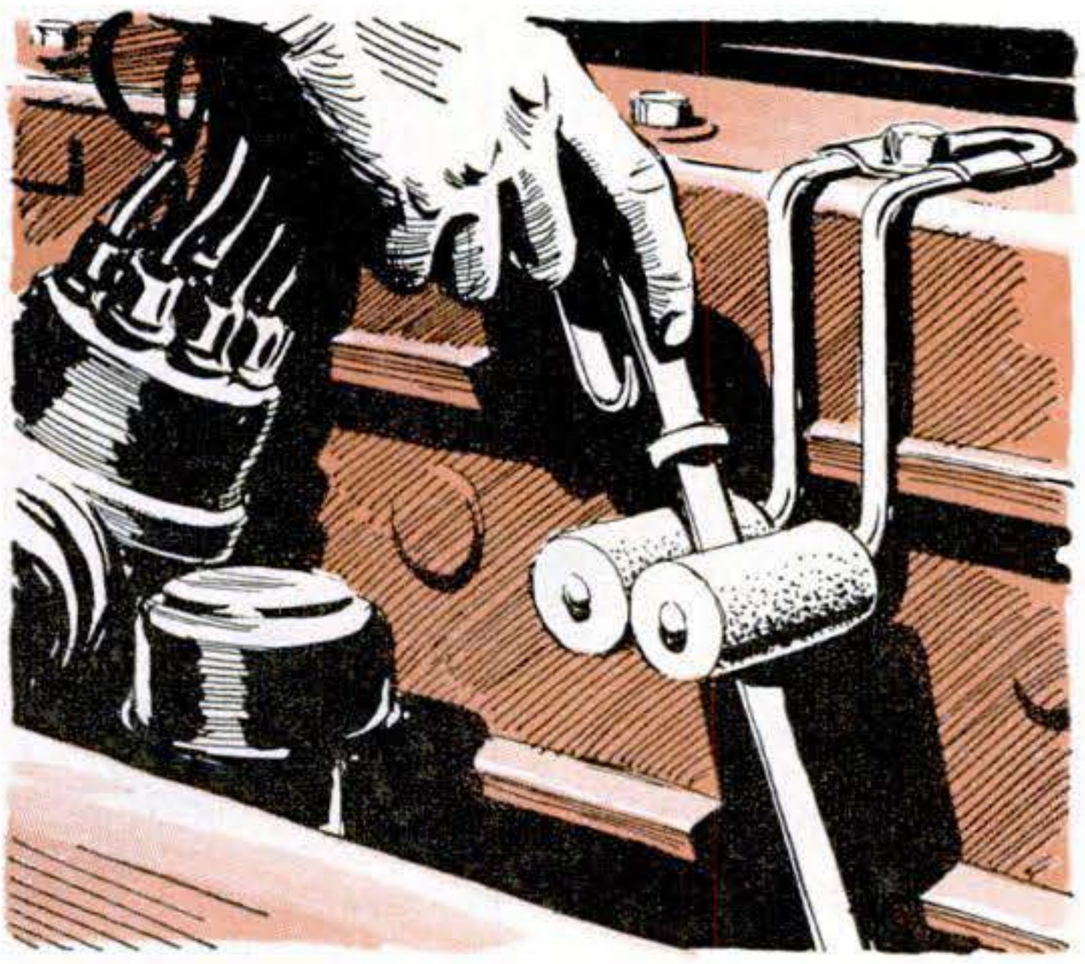
New Ideas

FROM THE INVENTORS



1 Boat to Walk or Float. A vessel that could step through marshes or over solid ground would never be landlocked by shallow channels or low tide. It could navigate unnavigable waters and "dock" itself on any handy beach. This amphibious craft would have a central hull flanked by pontoonlike steppers. When it struck bottom, its outer shell would rise and thrust forward—or backward—in a kind of leapfrogging motion.



2 Rollers to Wipe Dipstick. Checking your oil would be a cleaner and easier job if you had this gadget under the hood. The bent spring wire could be clamped to any convenient part of the engine; it would support a pair of replaceable, felt-covered wiper rollers. Before checking oil level, you'd simply draw the dipstick between the rollers.

3 Hanger Magnets to Grip Clothes. Dresses and other light-fabric garments might hang straighter if they were pinned down by magnets. A flexible yoke would support a pair of magnets above the bar of this hanger. Attracted to iron inserts in the hanger, they'd grip the cloth and keep it from bunching up or slipping sideways.

Please turn the page for more new ideas.

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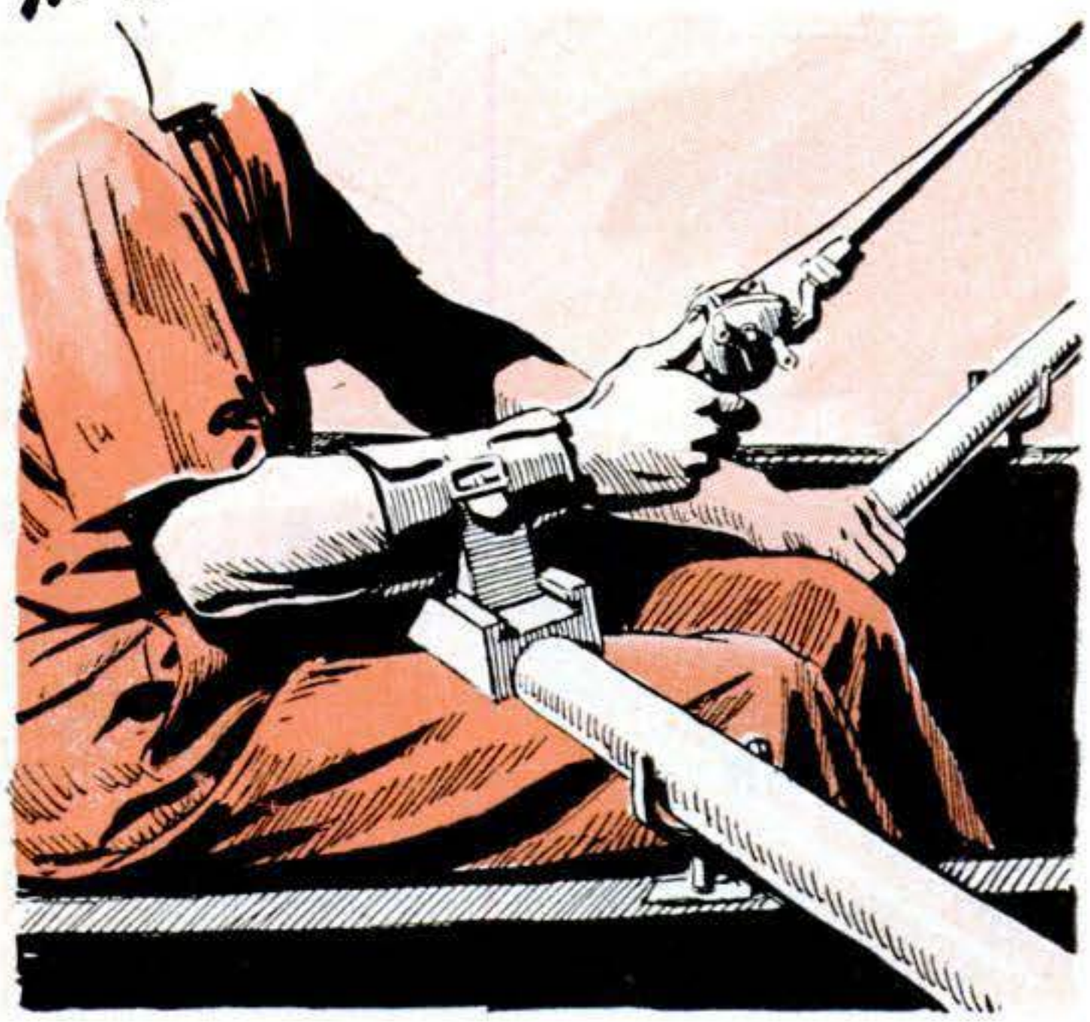
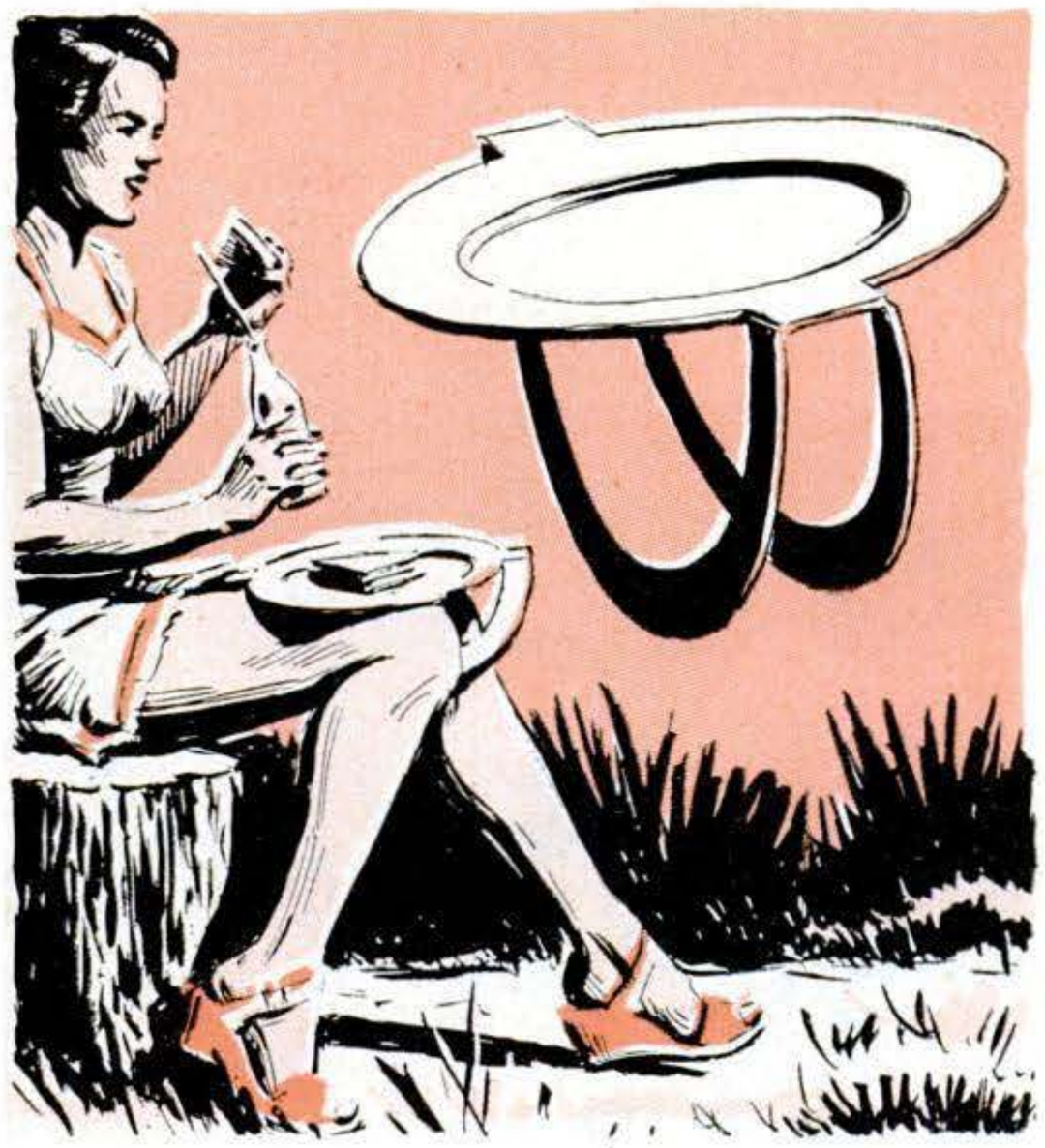
MORE New Ideas from the Inventors

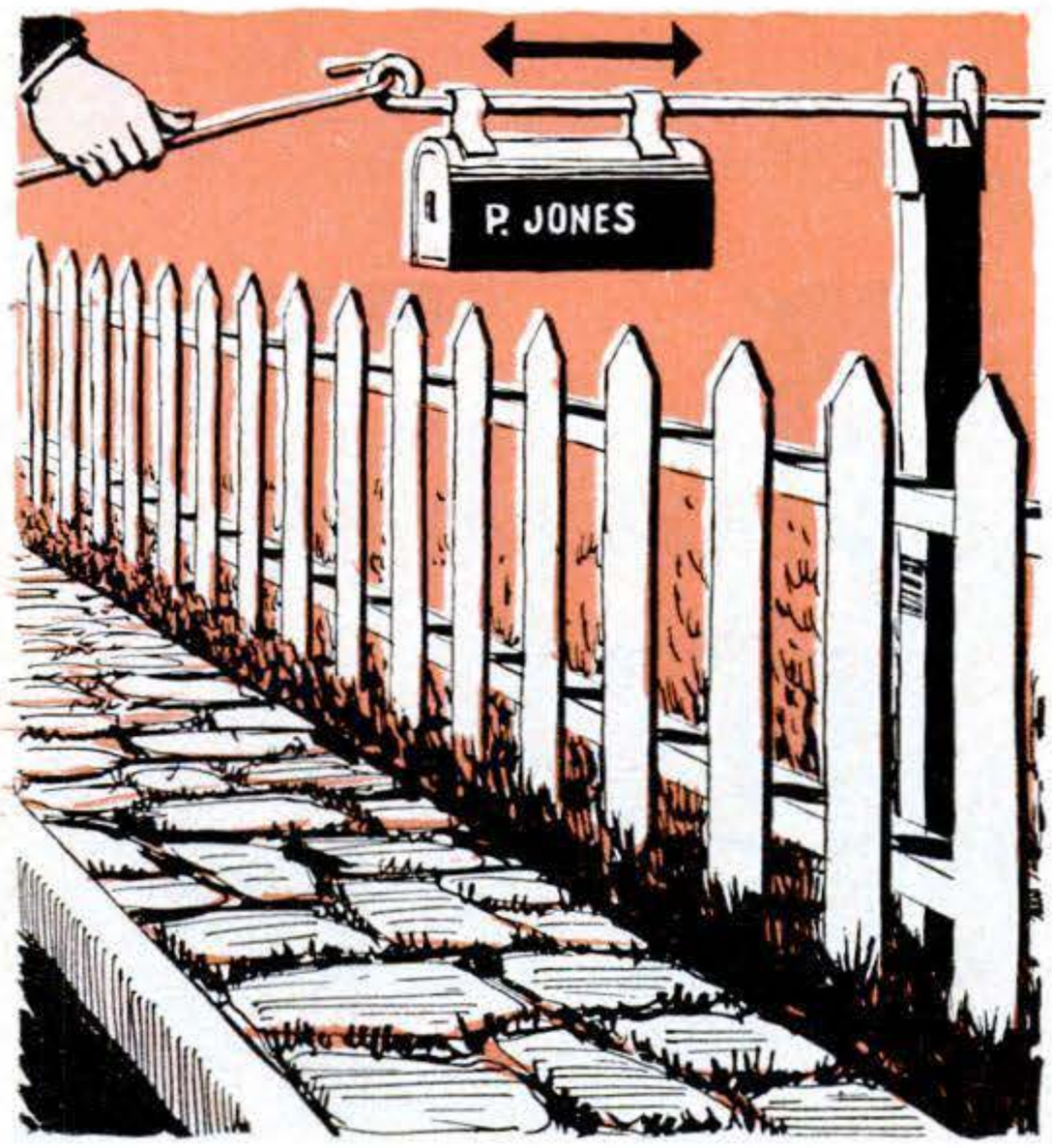


4 Oar Band to Free Rower's Hand. This two-part attachment would let a troller row with his wrist while holding his fishing rod in his hand. A ridged block fastened to a wrist strap would interlock with a grooved saddle that could be clamped to any oar. If the rower got a bite, he'd slide his arm to the side to free it from the oar.

5 Pen Nib to Filter Ink. Unlike either regular or ball-point pens, this new writing instrument would transfer ink to paper by filtering it through the pores of a special metal point. It is said that capillary action would keep the thick, pasty ink from leaking but permit it to flow when the point touched the paper.



6 Knee Grip to Steady Plate. To keep your picnic lunch from skating off your lap, you'd grip the fold-down rim of this paper plate between your knees. Intended for drive-in restaurants as well as for picnics and parties, the plate would be precut and creased so the user could easily bend down the legs as shown.



7 Box to Meet Postman Halfway. A mailman wouldn't have to get out of his car to reach an off-the-road box that was mounted on a sliding rod. He'd carry a long hook to pull and push the box. Slide-out boxes would be useful wherever sidewalks, muddy ditches, or snow banks might keep him from driving up close to the post.

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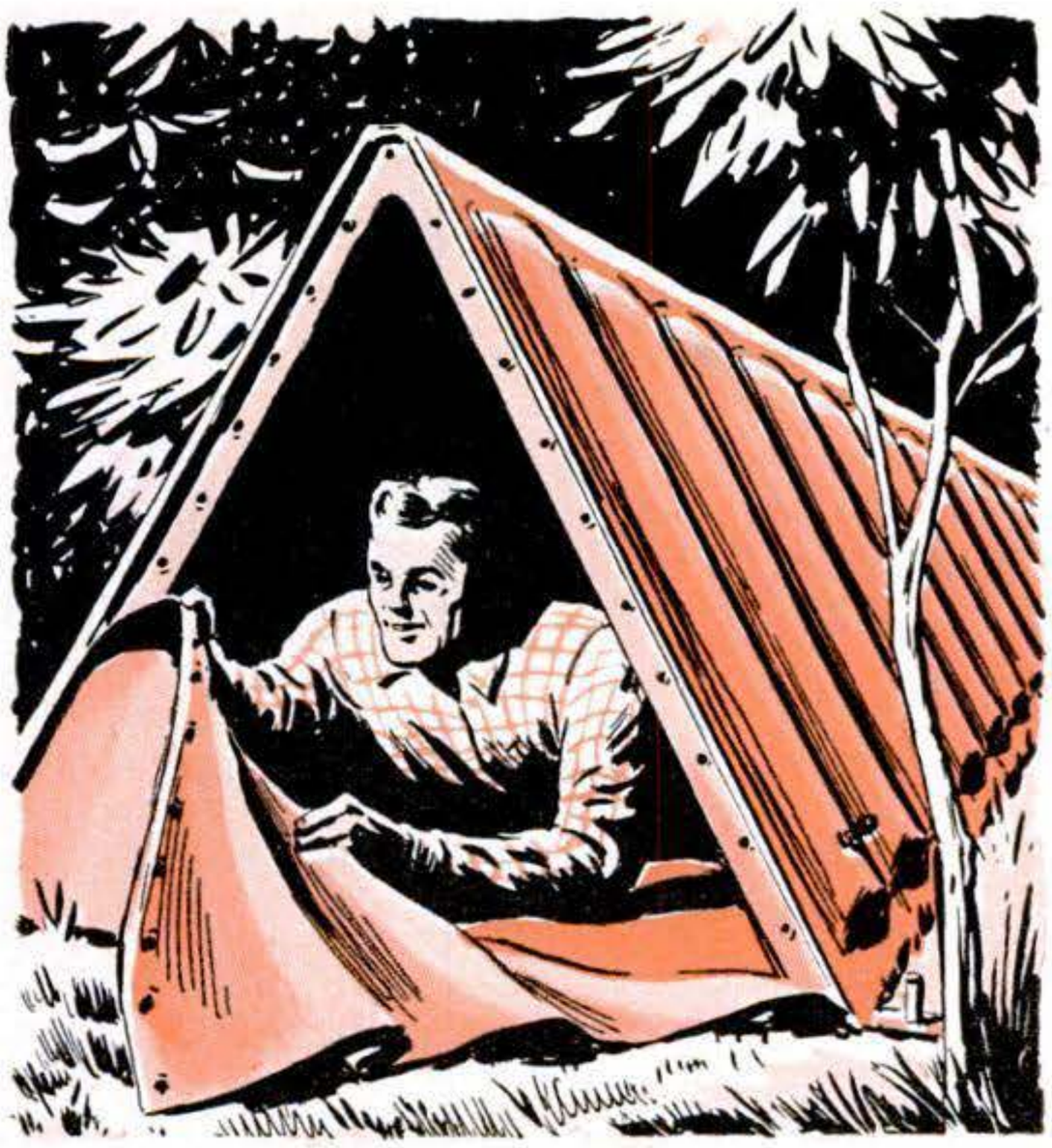
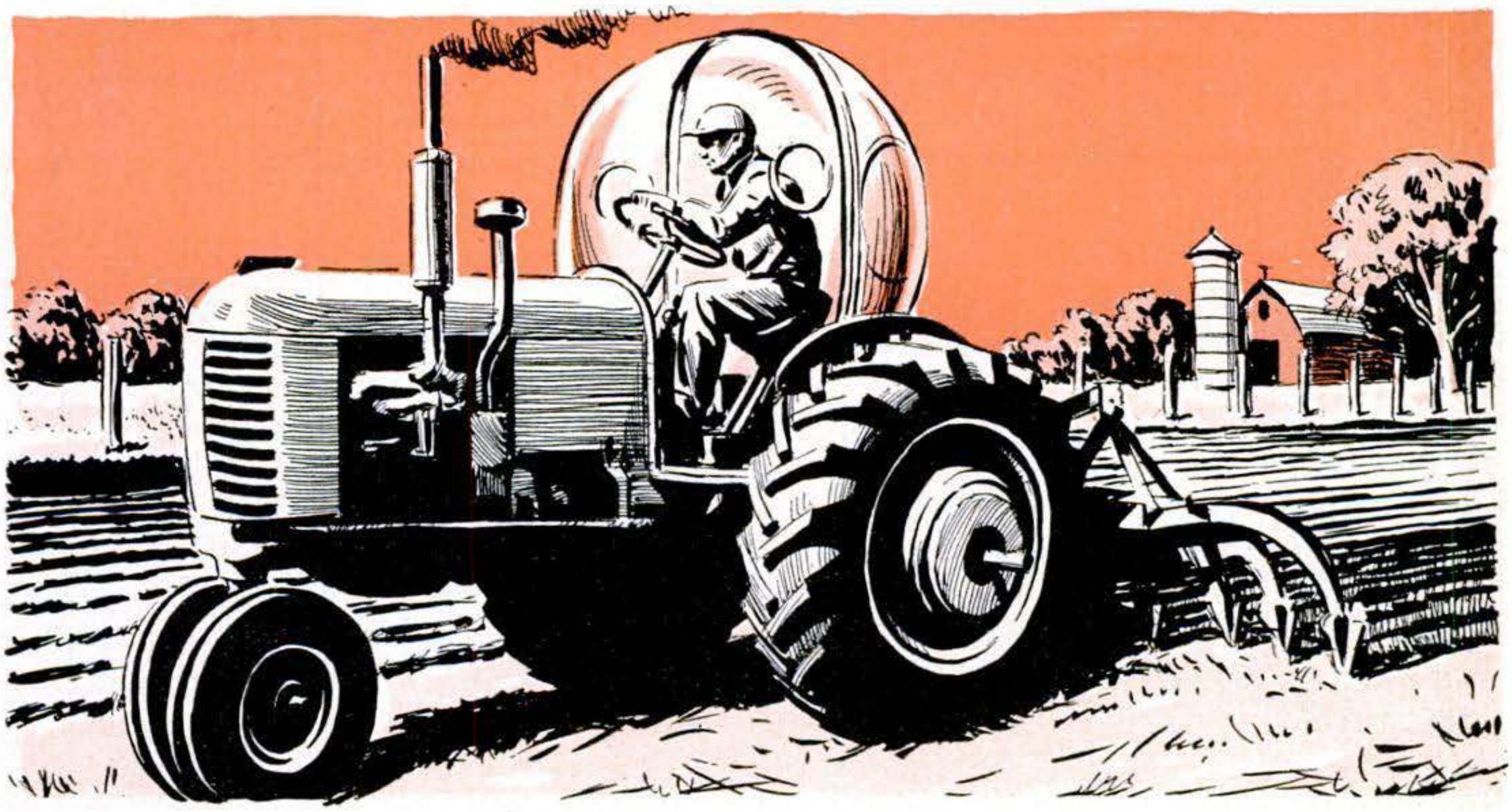


8 Air to Hold up Tent Walls. When pumped up, this combination sleeping bag and tent would support itself without stakes, and the inflated bottom would serve as an air mattress. The walls and bottom would be formed as a single piece; the sides would bend upward and zipper together at top. Deflated, tent would fold into a compact pack.

9 Chain to "Remember" Your Key. This tuneful chain would have a cylinder and plunger between the key end and the part that hooks to your belt. If you should forget your ignition key when you leave your car, the plunger would pull out of the cylinder and whistle a reminder. The parts would separate before the tug could tear your belt.



10 Bubble to Shield Tractor Seat. A clear plastic bubble that would close like a clamshell around a tractor operator would protect him from wind, cold, dust and rain, but would not reduce visibility. The rear hemisphere of this plastic enclosure would be fastened rigidly to the frame of a conventional tractor. The front half, shaped to fit over the engine hood, would be mounted on rails. An operator would slide the front section forward over the hood when he wanted to get in or out.

U. S. patents on these inventions have been granted to: 1. J. T. Tucker, Oxnard, Calif.; 2. P. L. McClaskey, Phoenixville, Pa.; 3. B. Weiss, Flushing, N. Y.; 4. P. Schaper, Chicago; 5. E. W. Rickmeyer, Prospect Heights, Ill.; 6. D. J. Olson, Minneapolis; 7. A. H. Kaschak, Bristol, Conn.; 8. B. L. Kreuzer, Denver; 9. G. H. Riviere, New Iberia, La.: 10. G. P. Baze, Idalou, Tex.

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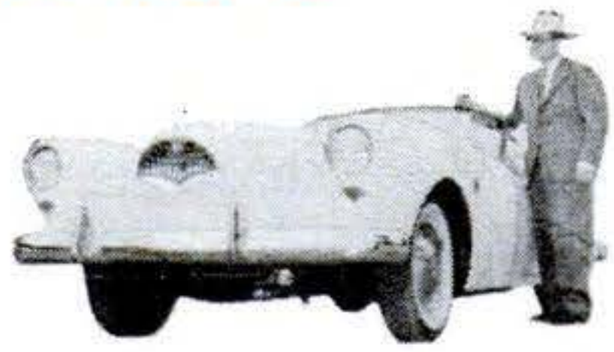
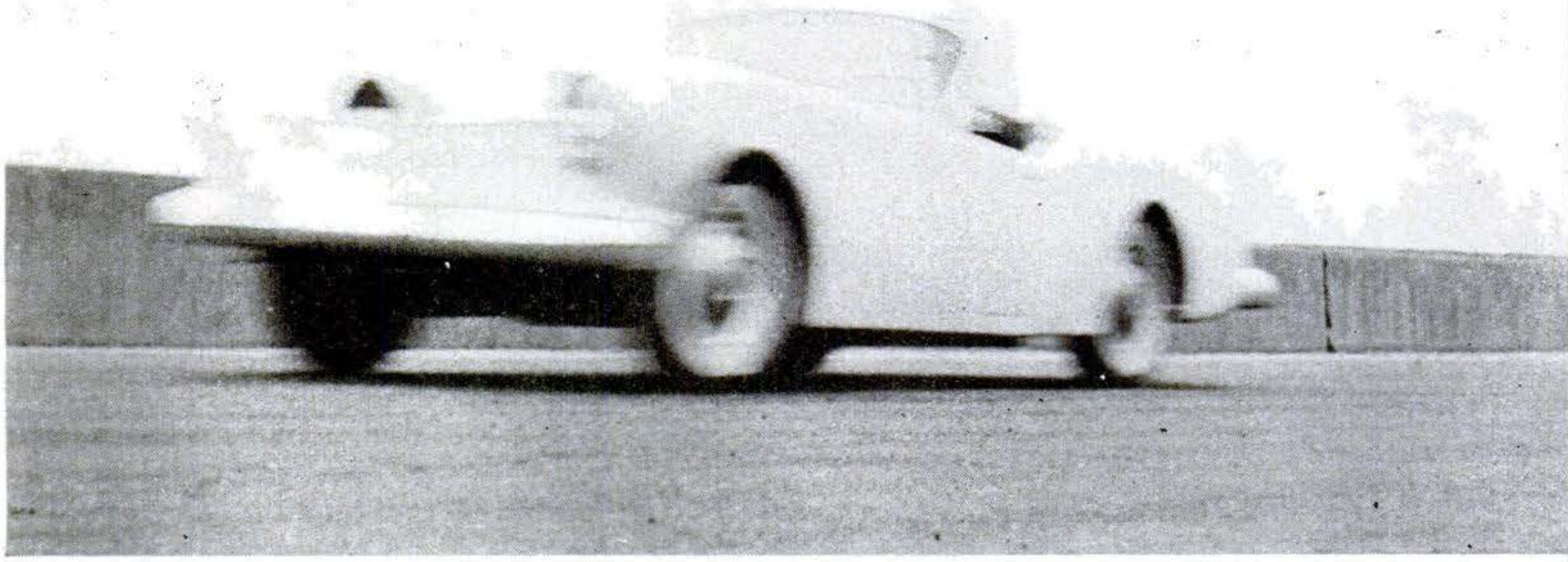
Plastic Kaiser Shows Its Sporty Ways



A seductive murmur from the exhaust is the tip-off to an acceleration and cornering performance worth experiencing.



With its modest 90 hp. the new Kaiser Darrin sports car gets under way surprisingly fast.

By Wilbur Shaw

IT'S the next thing to blasphemy in the beret set to taint the tires of a sports car by setting them down on a saucer race track, but to give the Kaiser Darrin 161 a whirl, I had one deposited for me the other day at the Indianapolis Motor Speedway. It was the handiest place I could think of where I could open it up without greetings from a traffic cop.

Willys, now a subsidiary of Kaiser and the actual manufacturer of the Darrin, has attempted no legerdemain with this car. It is powered with the company's 90-horsepower F-head engine, and has a standard three-speed transmission backed up with an overdrive unit. Its axle ratio of 4.55 is designed more for acceleration than high speed.

Sports-car drivers want a car that accelerates well, has a commendable top speed and, above all, "corners" well.

The Kaiser Darrin was entirely tractable in hard right-angle turns on dry pavement at an indicated 55 miles an hour. It began "breaking loose" on all four wheels just beyond that speed. This was with the rear-wheel "dig" provided only by high gear. It was here, in pulling out, that the axle ratio counted. On rough footing the car began coming un-

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A nice weight balance between the axles keeps the side sway in cornering to a minimum.

stuck from the road about 10 miles an hour earlier.

Before seeing what the car would do flat out, I checked the speedometer. Its error was about normal—3.7 miles an hour on the high side at an indicated 60 m.p.h., and just over six m.p.h. at 90. With a passenger aboard, top speed in third gear was an indicated 90. At that pace the tachometer in the instrument cluster registered 5,200 r.p.m. Top speed in overdrive was only slightly better—95.

Top speed in second gear was an indicated 70 m.p.h., with a tach reading of 5,800, and that in first gear 40 m.p.h., with the tach at 6,500. The little F-head engine revved up amazingly high.

All speeds were averages of runs with and against the wind.

Here are the average acceleration times:

Zero to 30 m.p.h., using first gear only: three seconds.

Zero to 40, using two gears: 7.5 seconds.

Zero to 50, using three gears: 11 seconds.

Zero to 60, using three gears: 14.7 seconds.

Time to the quarter-mile from a standing start: 19½ seconds.

DUE TO THICKNESS of material necessary for strength, plastic bodies aren't so much lighter than steel ones. The Darrin's weighs 300 pounds. Total weight is 2,175.

Measures Up to European Sports Cars

Esthetically, Darrin has done himself proud in the 161. (The designation is taken from the piston displacement.) The car can be stacked up against anything Europe has to offer in sports cars.

The Kaiser Darrin is the first mass-production U. S. sports car of this era. It's being made by Willys, along with Willys, Kaiser and Jeep, because the Kaiser people have fused all their automotive interests under the Willys manufacturing name. The "Darrin" comes from Howard A. Darrin, the custom-car designer who styled the job.

The car I drove was one of only 2,000 that Willys will make as a first and possibly only batch of plastic-and-fiber auto-

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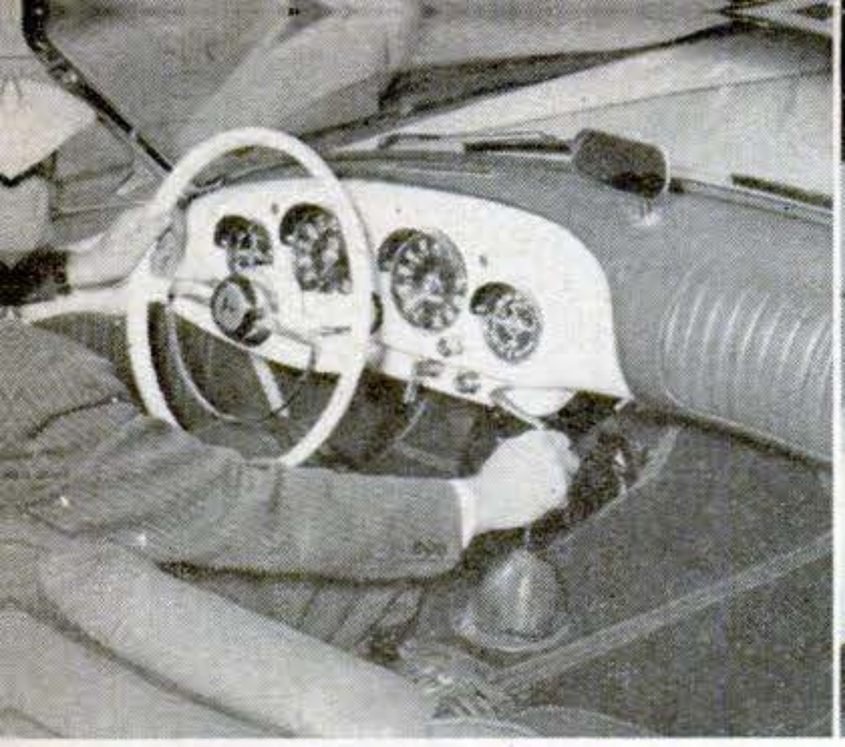
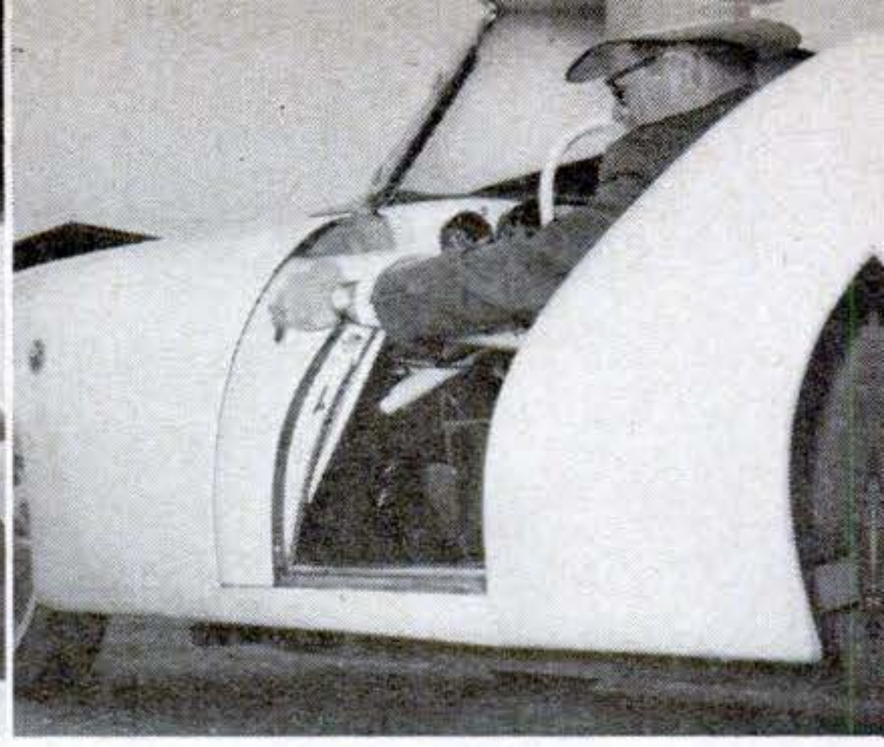


RIGHT HALF OF DASH is covered by a crash pad. All the trim, including that on the seats and folding top, is of embossed plastic cloth.

REAR DECK LID is split between two compartments—one for the top when lowered, the other for luggage. Only two molds are used to form main body structure.



TRICK SLIDING DOOR disappears into the fender when open but closes flush with the body metal. The frame is a modified Henry J's.

mobiles. When they have been manufactured and sold—at $3,668 a copy—the company will stop and look at the market. Chevrolet and Ford, the only other U. S. companies making production-line sports cars, are being equally cautious.

The prices on these cars are high not only because relatively few are being made, but also because plastic bodies are expensive to manufacture. Until they learn a faster way to do it, bury the myth that plastic cars can be turned out of molds as rapidly as cupcakes.

It's no great chore to mold the Darrin body, though it does require more man-hours than a steel body. The plastic is laced with fibers, in a steel or aluminum mold, and forced into shape like a felt hat, under heat and pressure. But then the problems start. Plastic pieces have to be cemented together, often bolted.

Finishing problems are complex. As the stuff comes from the mold, it has imperfections. That requires patching, and the plastic requires time to cure.

Slow "Crumple Rate" Means Safety

Yet the stuff must have a terrific capacity for absorbing impact stresses. In one instance a Darrin unexpectedly encountered a truck at a blind intersection at 40 miles an hour. The car wasn't much to look at after the dust settled, but the driver walked away unscathed. He was saved by what engineers know as the slow "crumple rate" of the body material.

Plastic bodies are also excellent sound dampers. They filter out extraneous noises. That's one reason why the seductive tailpipe music of the Kaiser Darrin comes through so clearly, as deep-toned as any sports-car lover could ask. END

FACTS ON KAISER DARRIN 161

Model: sports car.

Engine: 6-cyl., F-head in-line; 90 hp. at 4,200 r.p.m.; compression ratio, 7.6:1; piston displacement, 161 cu. in.; piston travel (in feet per car mile at 20 m.p.h.), 2,101; bore and stroke, 3.125" by 3.5"; crankshaft bearing surface, 30.14 sq. in.; torque, 135 lb.-ft. at 1,600 r.p.m.

Weight: 2,175 lb. (without gas and oil); per hp., 24.1 lb.

Transmission: 3-speed manual shift; rear-axle ratio with overdrive, 4.55:1.

Steering ratio: 24:1; radius of turning circle, 17½'.

Effective brake-lining area: 176 sq. in.

Springs: front, coil; rear, semi-elliptic.

Outside dimensions: height, to highest bow of top 50.8", to base of windshield 36"; over-all length with bumpers and guards, 184"; width, 67.5"; wheelbase, 100"; overhang, front 35", rear 49"; tread, front and rear, 54".

Inside dimensions: seat-cushion widths (total), 50.6"; leg room, 46.8"; headroom, 35.6"; seat height, 9.8"; vertical distance, steering wheel to seat cushion, 5.2"; seat adjustment, horizontal 5", vertical 0".

Tire size: 5.90 by 15.

Price: $3,668, Toledo, Ohio.

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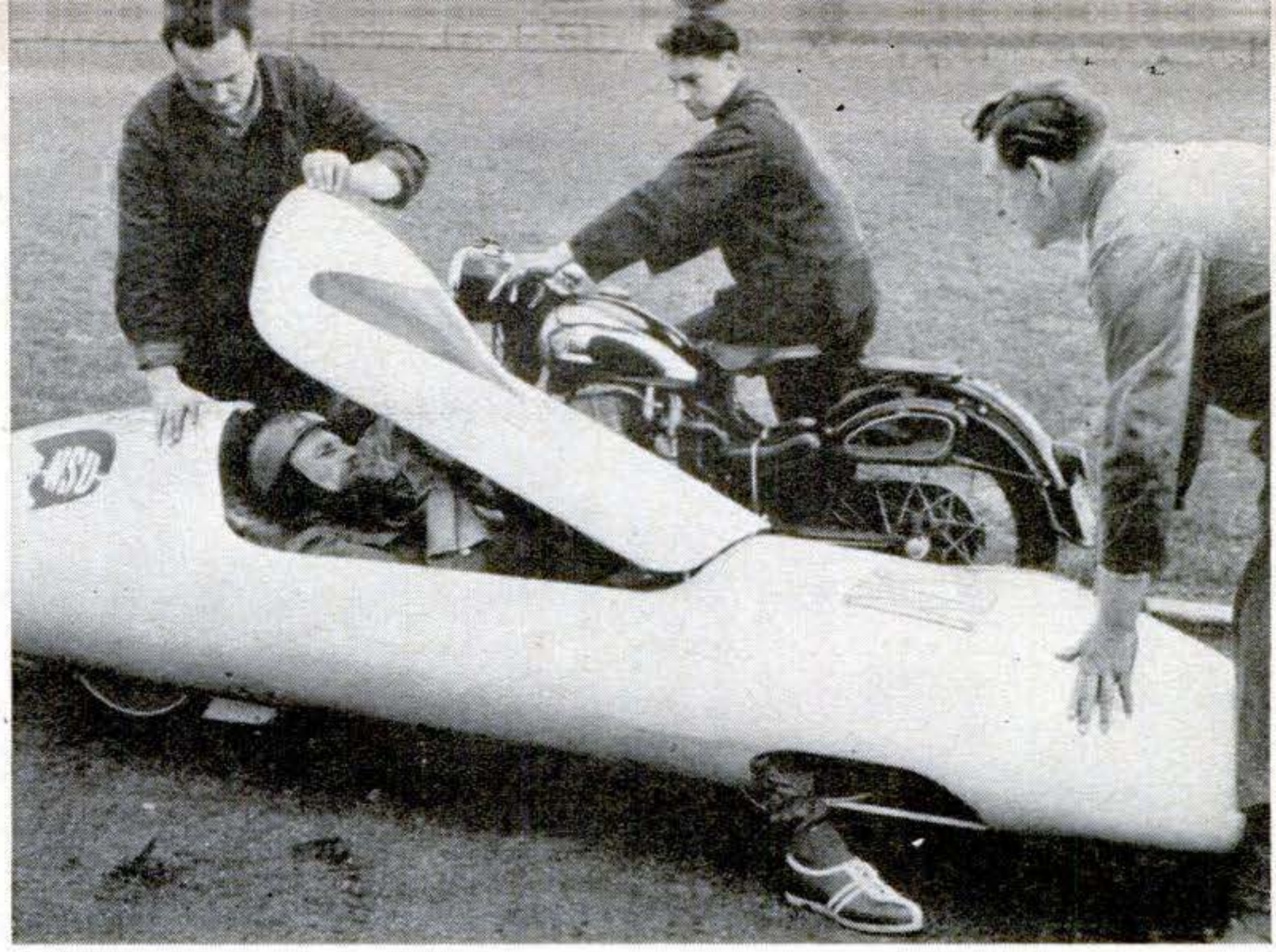
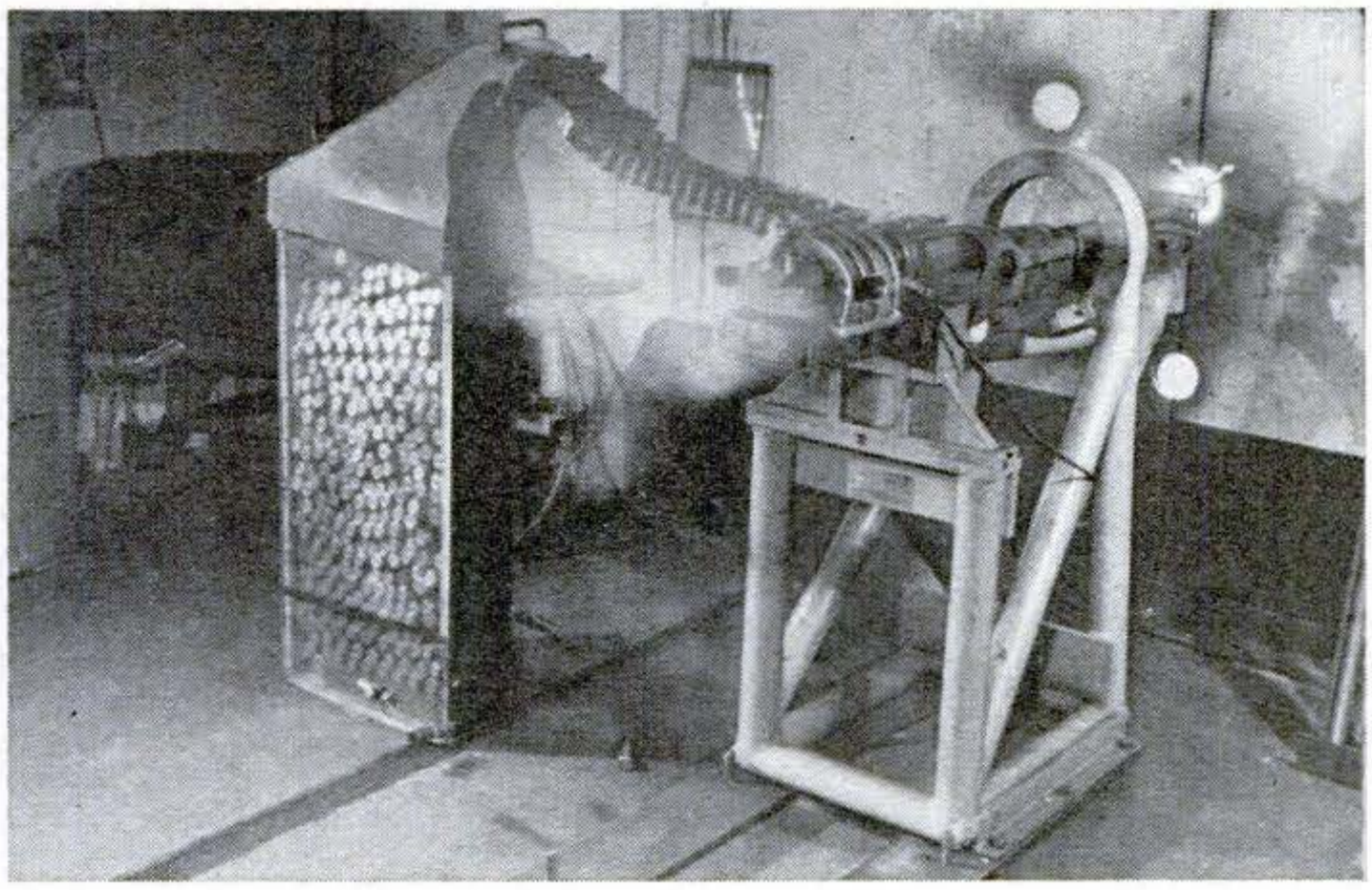
Racer Takes Speed Trials Lying Down

THE Flying Deck Chair is what they call this superstreamlined motorcycle now trying for speed records in Germany. It is so low that the driver-designer—a bearded six-footer named Gustav Adolf Baum—pilots it while lying flat on his back.





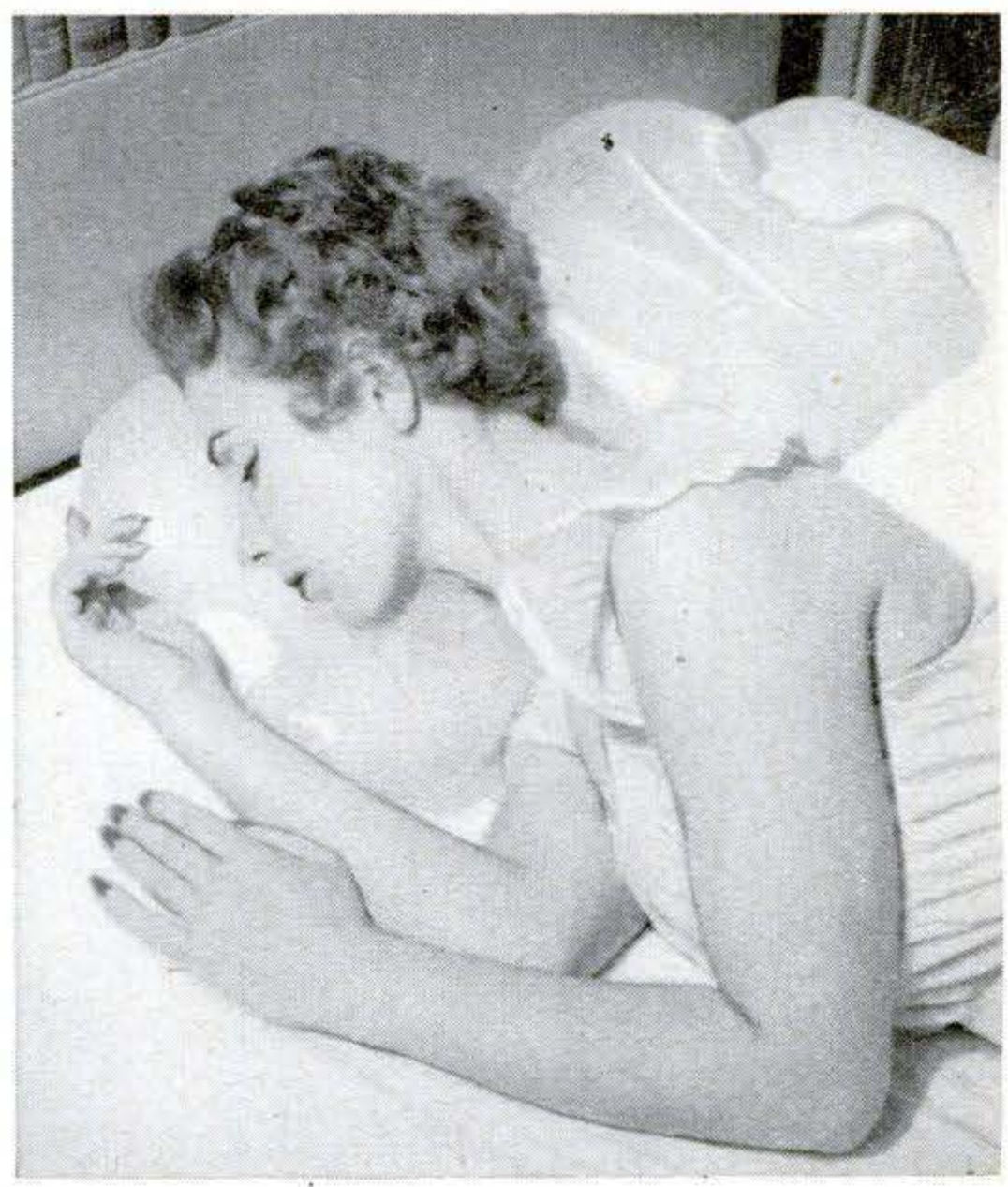
New Aircraft Cannon Shoots Like Six-Gun

THEY'VE modernized the old six-shooter into the fastest automatic weapon U.S. forces now have. That's the new M-39, shown at left blasting away on a Ford test range. It uses the revolver principle to fire 20-mm. shells. Developed from a German design, the gun was tested in combat in Korea. It is credited with destroying seven MIGs.

Water-Cooled Plastic Pillow Has Notches for Your Nose

BEFORE inflating this plastic pillow, you pour in some water. By conducting heat away from the body, the pillow cools the fevered brow on hot nights or soothes an aching head.

The odd notches cradle your head and let you breathe in any position. Better Sleep Co., New Providence, N.J., makes it.



Southpaw Can Wind This Watch

A LEFT-HANDED watch is no gag any more. Southpaws can now get wrist watches with the stem at nine o'clock instead of three, so that they can be worn on the right and wound from the left. They are sweep-second Hamiltons with faces rotated a half turn.

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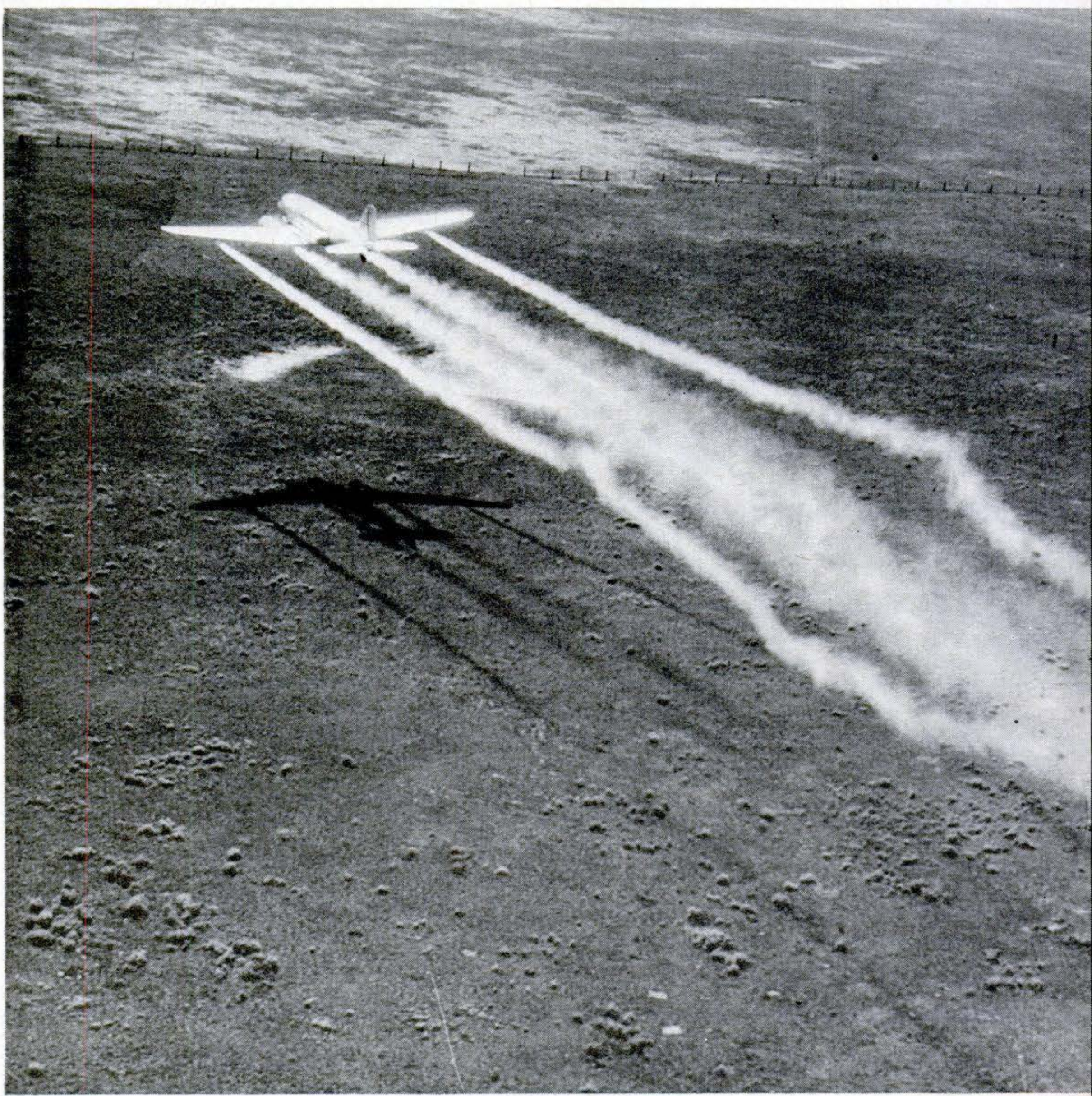
This is the year that

Science Licks the Grasshoppers

Death for 500,000,000 grasshoppers in 15 minutes descends in an aldrin mist from a DC-3.



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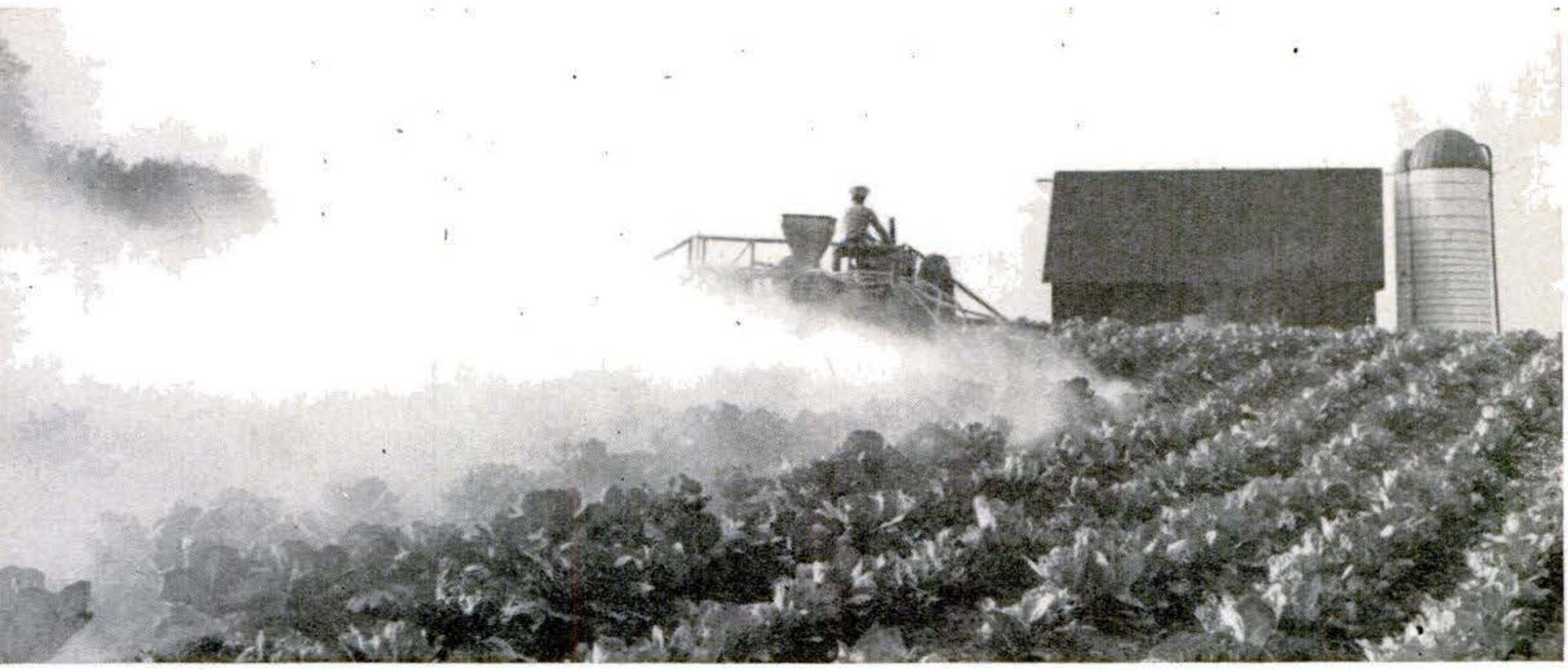

Many-tentacled spraying machines seek out and kill the marauding insects in small fields.

Victory over an ancient enemy now seems assured, as planes and machines attack with new, deadly chemicals.

By B. F. Sylvester

ONE of mankind's oldest foes is launching a savage attack on the western two-thirds of the U.S. this month.

Grasshopper hordes for weeks have been gathering in fence rows, along weedy roadsides, in ditch banks and under the surface of waste and idle lands.

Their campaign plans are known. Primary targets for this year are central New Mexico, southern Colorado, northern Wyoming, eastern Utah, southern Oregon and central Idaho. Secondary targets include other parts of Colorado, New Mexico, Oregon and Utah, plus Arizona, Nevada, Montana, Nebraska, Wisconsin and single fields in Missouri. Skirmishes are scheduled, in all, for some 22 states.

THE FACE OF THE FOE looks smug, perhaps because the battle went his way so long.

But the grasshoppers are in for a staggering surprise.

This year, armed by science, the U.S. is ready for them with new weapons that will smite the hoppers on the ground and blast them from the skies. We have chemicals that to the insect world are the equal of H-bombs. Furthermore, we have the means to deliver them to targets that are already pinpointed, down to the last farm in Iowa and the least suspected mountain slope in Colorado. Every county agent in the target states has a map showing where the egg beds are. So does every farmer who has asked for one.

Thus victory looms in one of the longest wars the world has ever known.

Even before men began writing history, grasshoppers were periodically stripping the land, forcing grazing animals to hunt grass elsewhere and carnivorous animals to follow the fleeing rabbits, mice, squirrels and birds. The records of ancient Greece, Rome, China and Israel contain many a grim account of grasshopper plagues.

"The land is as the Garden of Eden before them, and behind them a desolate wilderness, yea, and nothing shall escape them," mourned the Prophet Joel.

The American Indians suffered, too;

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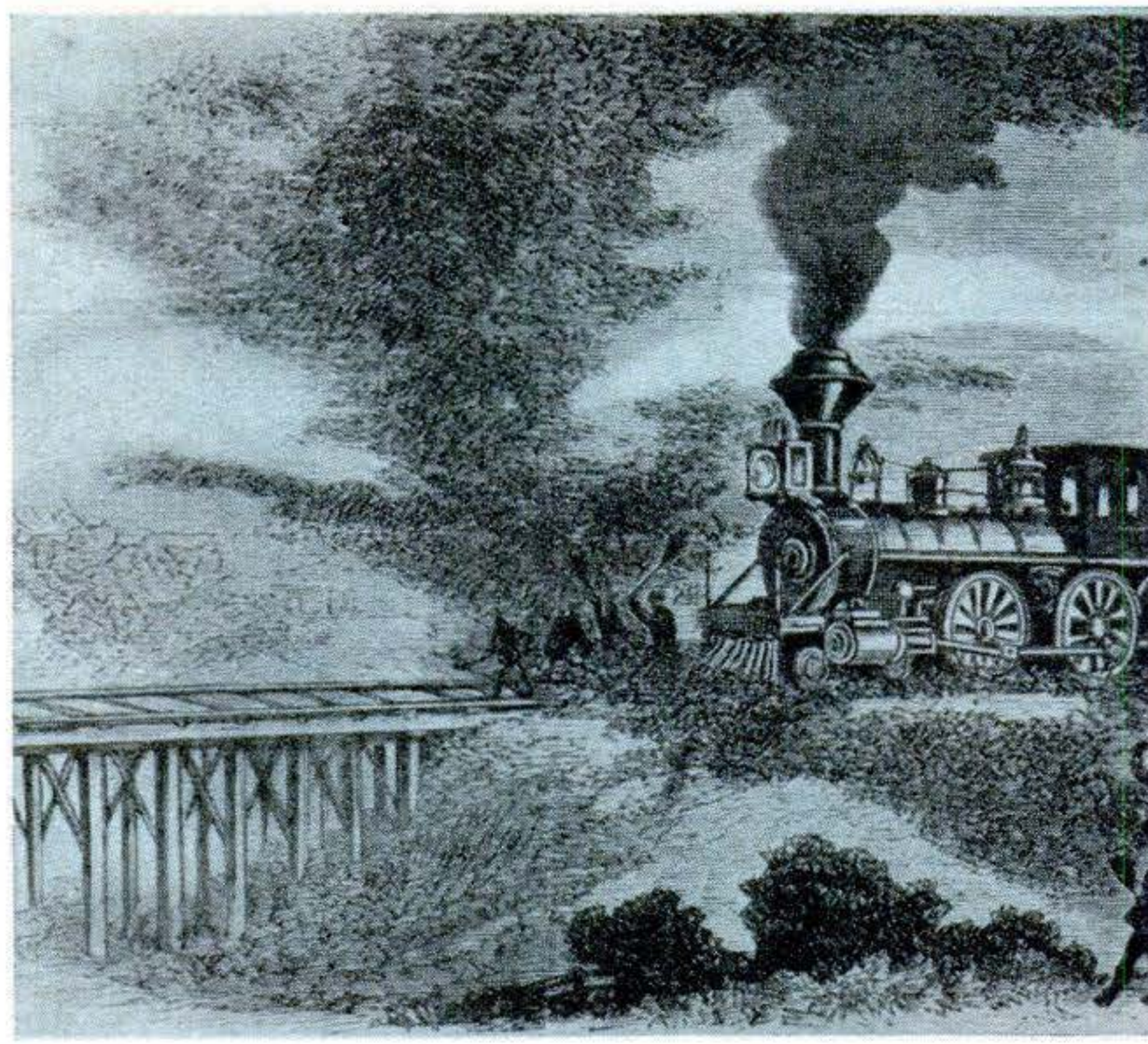

Scenes of historic defeats in the Grasshopper War

CLOUDS OF HOPPERS attacked the peoples of Biblical times (left, above), leaving helpless tribes of men to starve and die.

years after it happened, an old chief told of a migration of grasshoppers that drove his tribe out of northwest Iowa in 1833 and left the countryside as black as if it had been swept by a prairie fire.

Destruction from the Sky

In July, 1874, a fantastic swarm of the insects—their wings grown as much as a half-inch longer than normal, their nervous systems stimulated by a mysterious impulse that periodically urges them to get up and go—dimmed the daylight over Colorado, Nebraska, Kansas and western Iowa. One flight was 300 miles long, 100 miles wide and a half-mile high, and was estimated to contain more than 120,000,000,000 grasshoppers. The noise of their wings sounded "like a rushing storm." They dropped into the fields and ate every green thing. They devoured potato vines and followed them into the ground for the potatoes.

A farmer's wife had started for town in her wagon with tubs of fresh butter, covered with towels. A great cloud of the insects appeared in the sky. The frightened horses balked. The cloud descended, attacked the wagon and ate the towels off the butter. The woman finally managed to whip her team into frantic action and fled for home, where she tried to save her cabbages by covering them with old clothing. The insects ate the garments and even chewed up the shades on the farmhouse windows. Weather-beaten buildings soon looked as if they were made of new lumber. Green corn was bent to the ground by the weight of the grasshoppers by day. Branches in the treetops bent and broke under them at night.

The Futile Flood

In the wake of this historic attack, a soothing flood of inventions intended to prevent its recurrence poured into the farm states: the Hetzel Burning Machine, the Drum Locust Crusher, the Atwood Sulphur Fume Machine, the King Suction Machine, the Canfield Pan, the Anderson Coal Oil Contrivance, Mr. Thompson's Net, and others, all equally ineffective.

The hopper 'dozer came out about the same time. Drawn over the fields, it collected hoppers by the hundredweight to be sacked up for hog feed.

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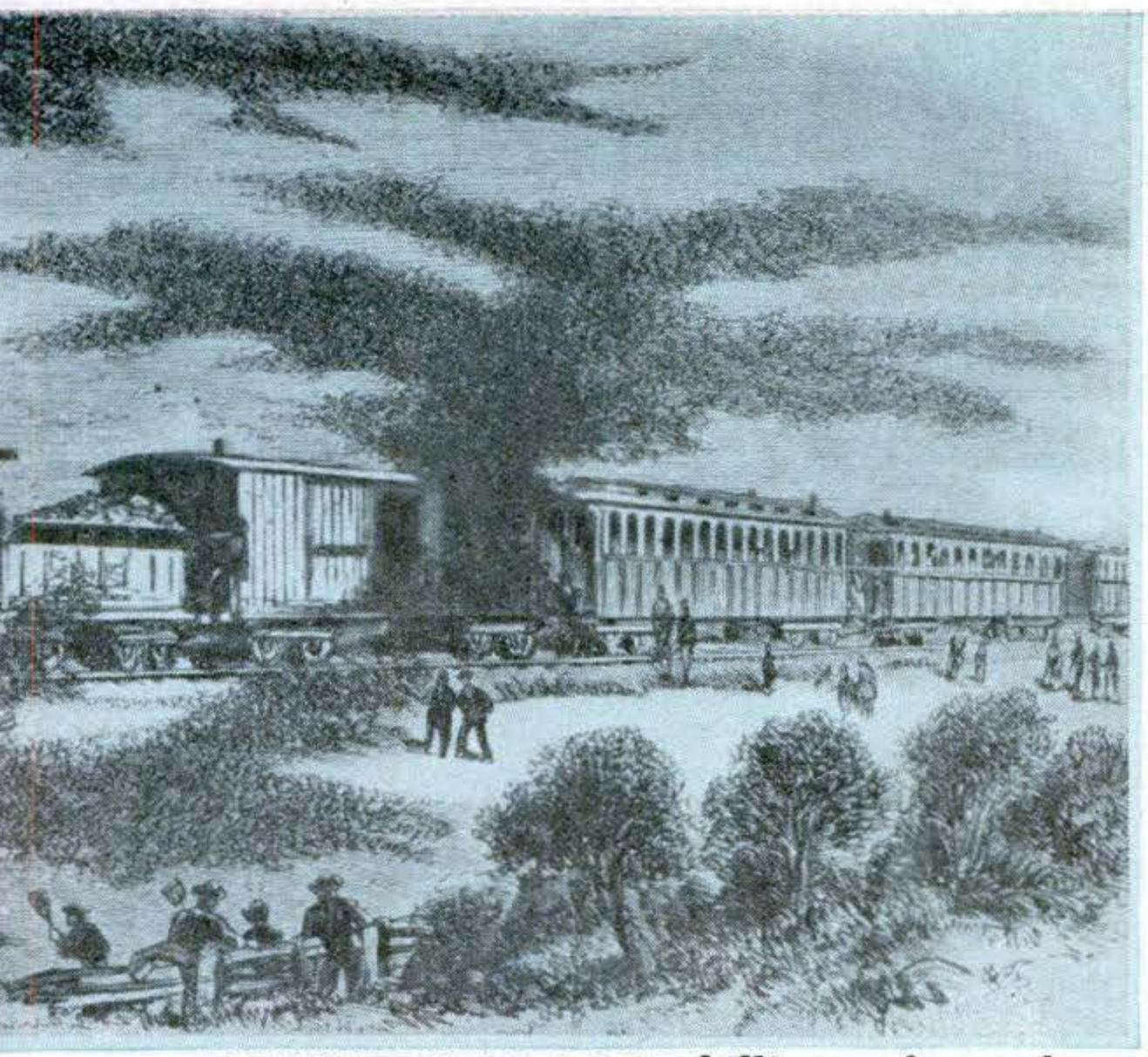

TRIUMPHANT IN DEATH, billions of grasshoppers that scourged four great U.S. farm states in 1874 even halted trains with their bodies.

SWATTING THE PESTS, a tactic that has proved futile for at least 4,000 years, was still this Nebraska farmer's only resort in 1876.

Poison bait, introduced in 1885, went west by the carload. But not until the last three years has science armed farmers with means effective enough to turn the tide of battle. Even now, along a belt stretching from Africa to India, grasshoppers threaten the food supply of one-fifth of the world's population. Under the Point Four Program, the U.S. is helping to fight the greedy insects on that distant front.

Today's weapons are chlorinated hydrocarbons, poisons of both the contact and internal varieties. DDT was not effective against grasshoppers. They ate it with relish. They began to get a disagreeable and fatal mouthful, though, when the chemists followed it up with hexachlorocyclohexane and then chlordane. After these came toxaphene, heptachlor and aldrin (its chemical name is two lines long).

Aldrin is so powerful that two ounces of it will kill virtually all the grasshoppers on an acre of land and any others that enter that territory for a week afterwards.

Newer and still more terrible, with an even longer chemical name, is dieldrin, a half-ounce of which will do as much damage to grasshoppers as two ounces of aldrin.

This year, as the grasshoppers take wing, American farmers are able to mobilize 5,000 planes against them. Government DC-3s will smash the bases of potential insect flights. Ranchers will hire aircraft like the B-17 owned by two Nebraska brothers. It carries 12 tons of chemicals and kills the grasshoppers on 3,000 acres—a billion and a half, in a heavy attack—in 40 minutes.

Victory in Sight

On foot or from jeep or truck, the typical Iowa farmer can spray the hatching beds on his land in 20 minutes. If some of the young insects escape to move into his crops, he can spray 200 acres from a small plane in an hour. When infested areas cover 5,000 acres or more, state leaders in the battle will organize large control units, their cost to be shared by the U.S., the state and the individual farmers.

"I think," Dr. H. M. Harris, Iowa state entomologist, confidently declares, "that the grasshopper is licked." END

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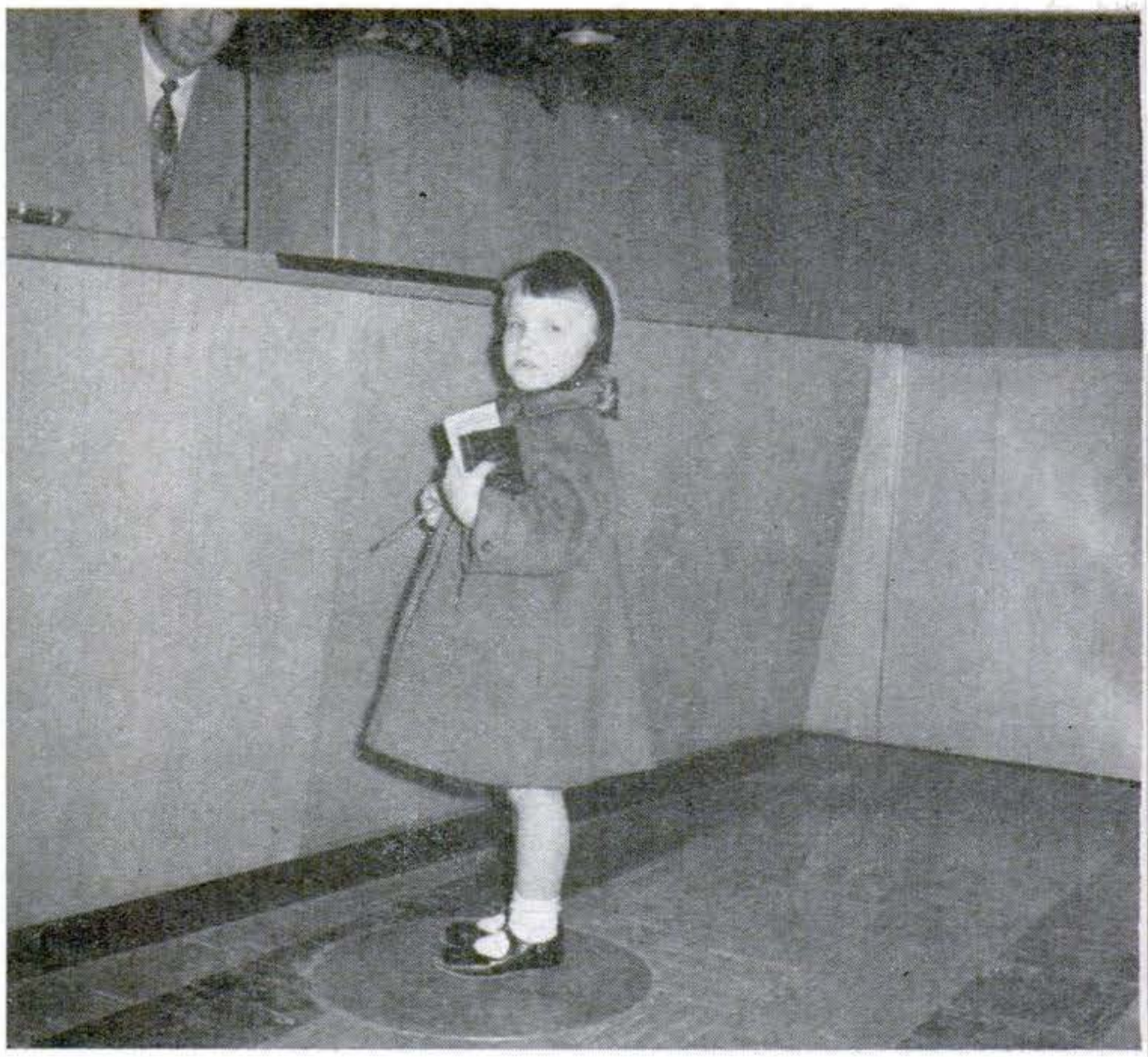
No Deposit or Depositor Too Small for This Bank

ALL a member of the lollipop set in Geneva, Ill., has to do nowadays to see what's going on down at the First National Bank is step onto a red spot in front of window No. 5 and wave the long green stuff.

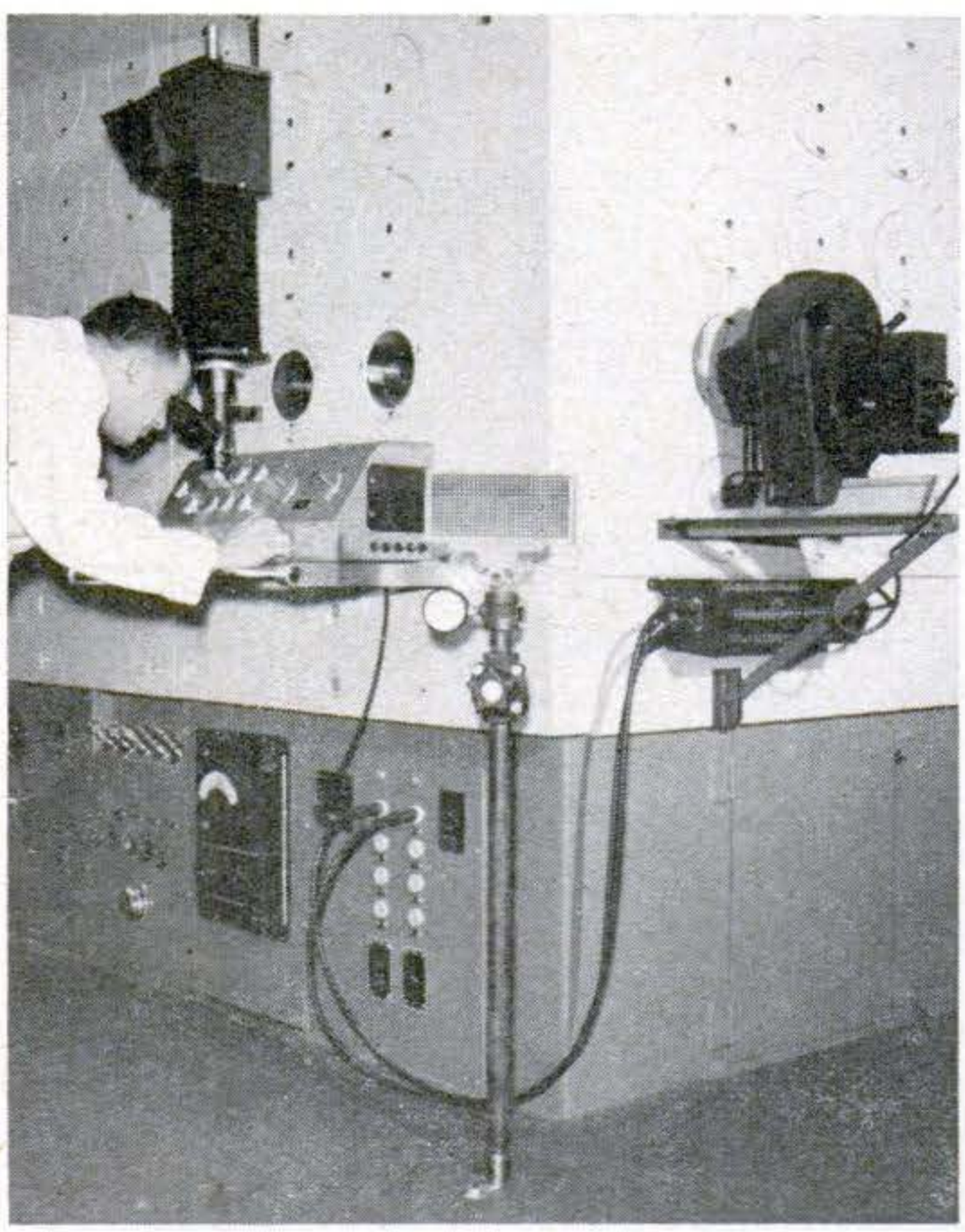
From then on it's just click, swish, and a youngster is standing as tall as daddy, pushing his (or her) savings over the counter.

The secret is that red spot on the floor. It is a small elevator, controlled by teller No. 5 and powered hydraulically by machinery in the basement. A local firm made it from farm-equipment parts. It has a telescoping steel shroud—like a collapsible drinking cup—to make sure tiny toes aren't squashed.



Bandage Needs No Wrapping

THE nurse above is applying a new tubular bandage, peeling it in layers from a cagelike contraption to fit it over the patient's head. The English maker claims that Tubegauze can be applied to various parts of the body in seconds.



Hot Metal Studied from Afar

THE microscope goes to the specimen when it's a piece of "hot" metal. At Hanford, the radioactive sample is inside the cell above. An arc lamp outside (right) lights it, and a microscope, also outside (left), views it through a window.

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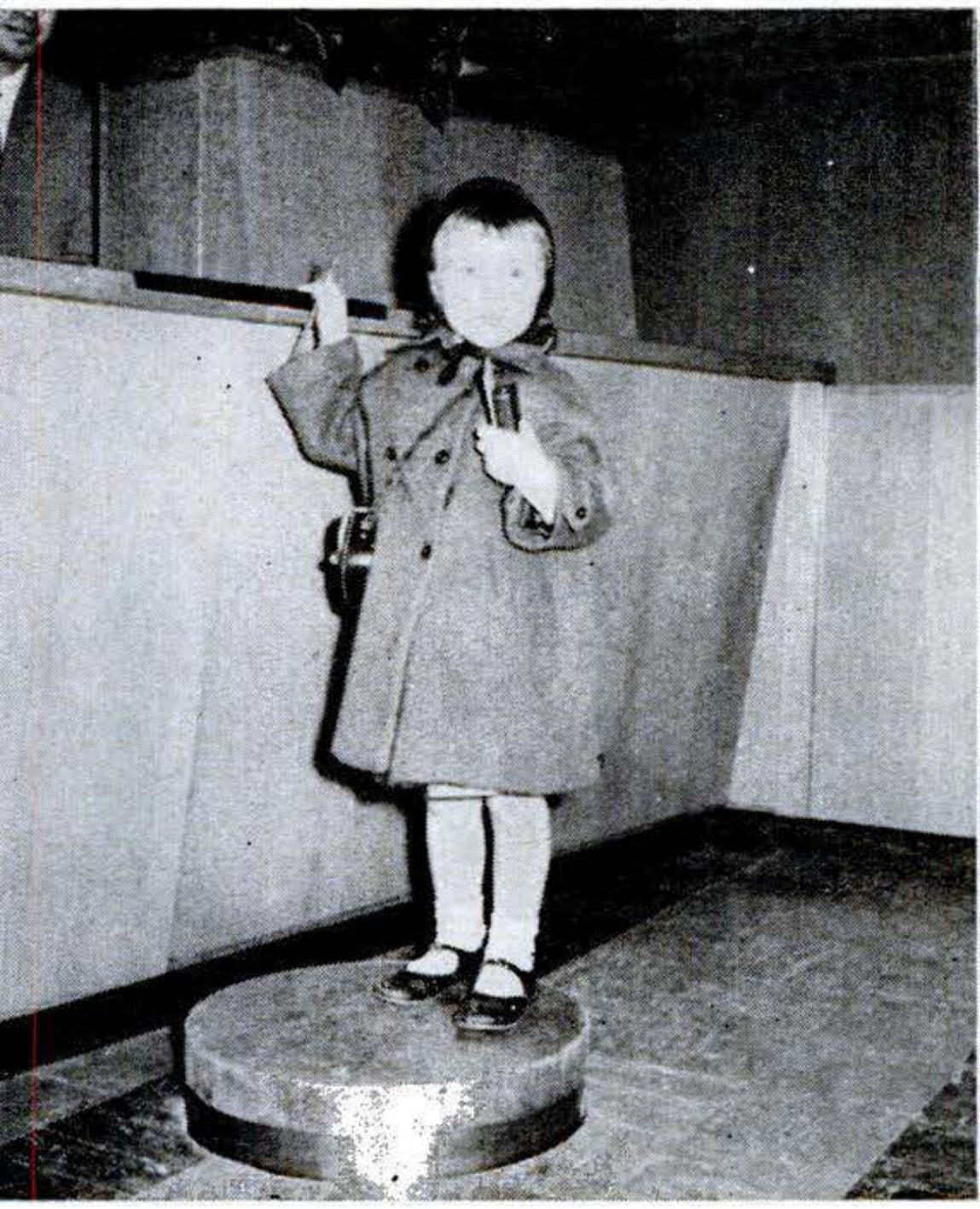
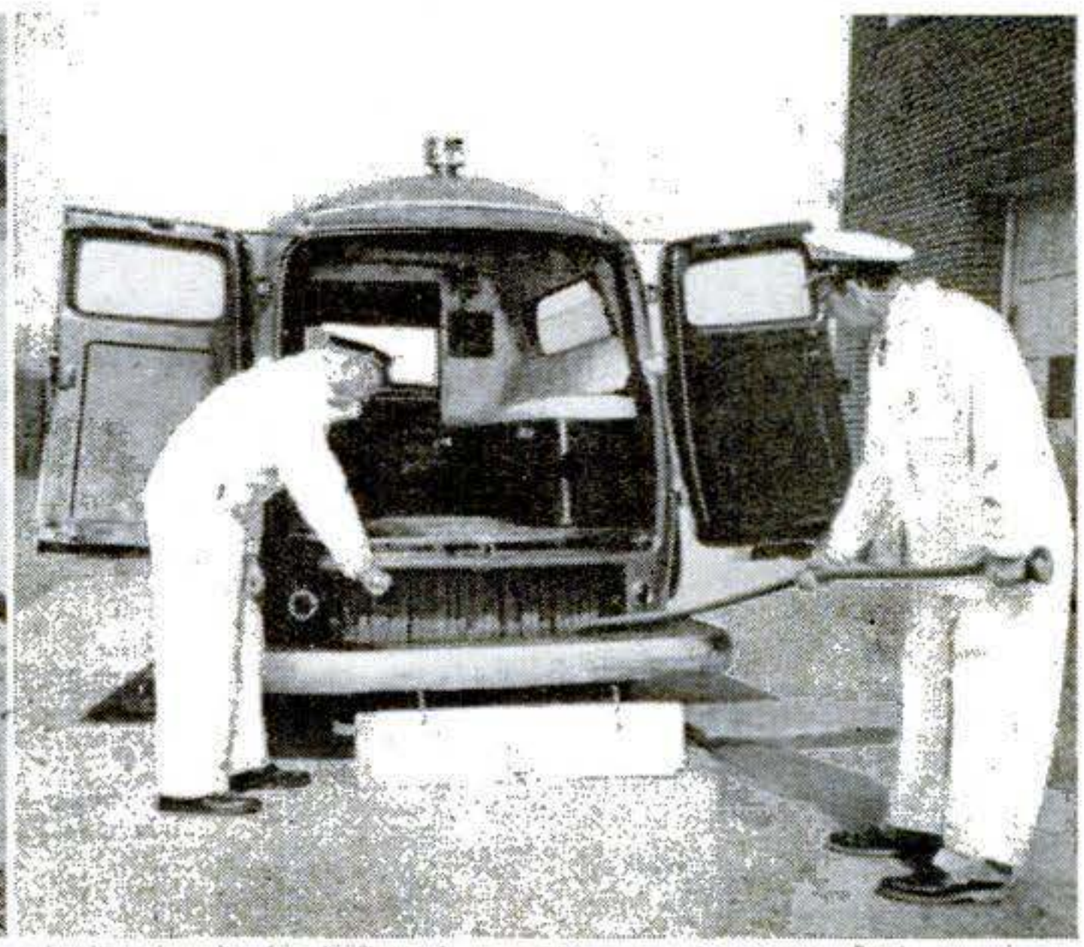
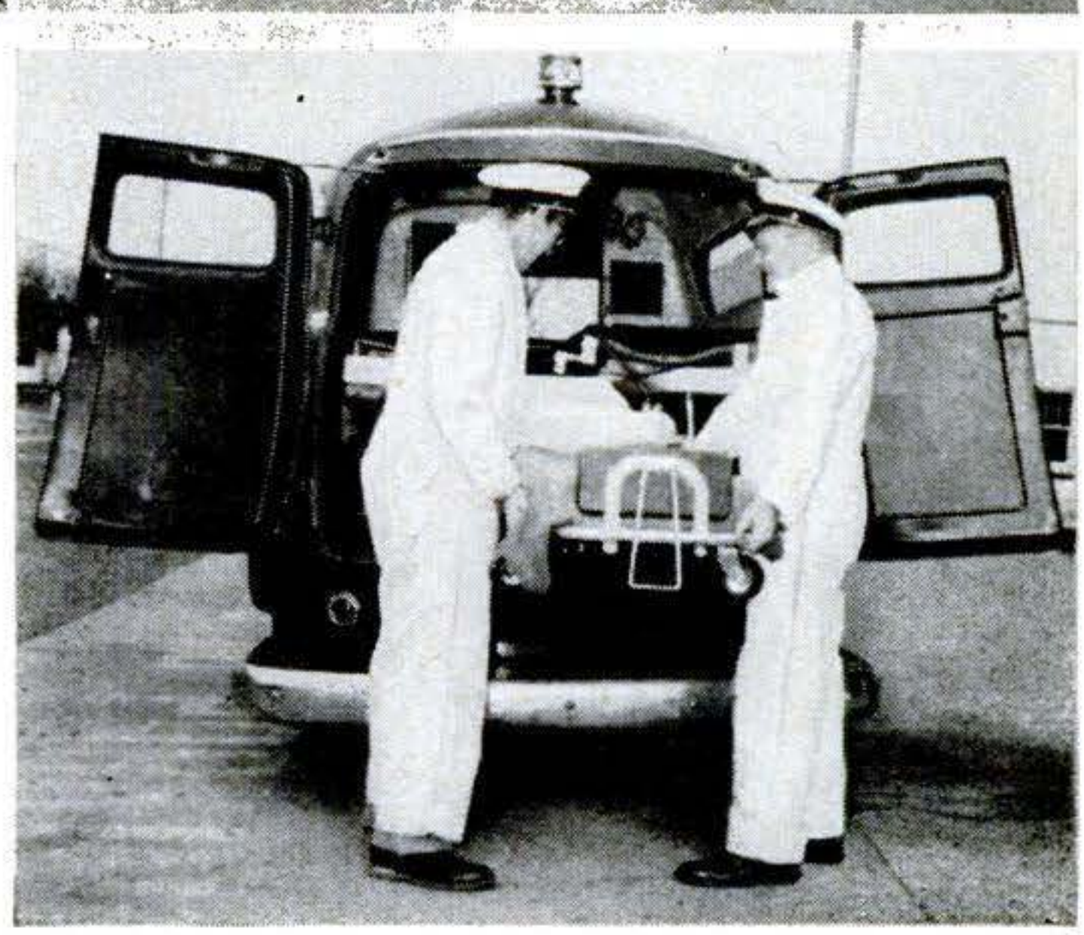




Fire Truck Is Ambulance, Too

In Menlo Park, N. J., a two-man fire engine that can also serve as police car or ambulance investigates a blaze before the fire fighters make an all-out dash. Hoses coiled under the running boards pump 200 gallons a minute from built-in tanks or from hydrants. A hose above the rear bumper (upper right) pumps foam. Two bunk beds with space between for a stretcher let the truck double as an ambulance (right). Resuscitators, oxygen tanks and other gear (above) are stored in the cab. The Christopher Co., NYC, makes the FAPA truck.



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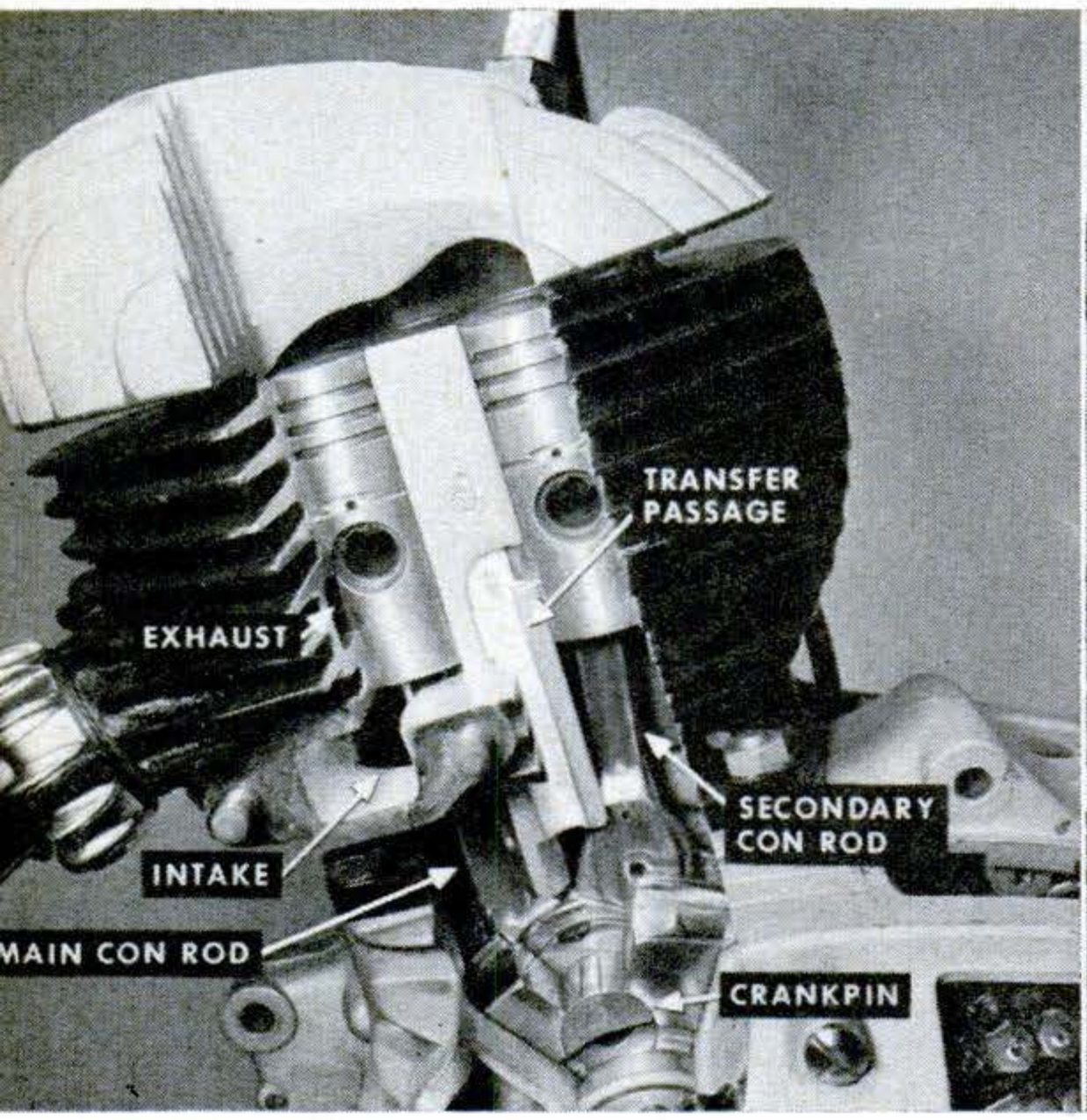
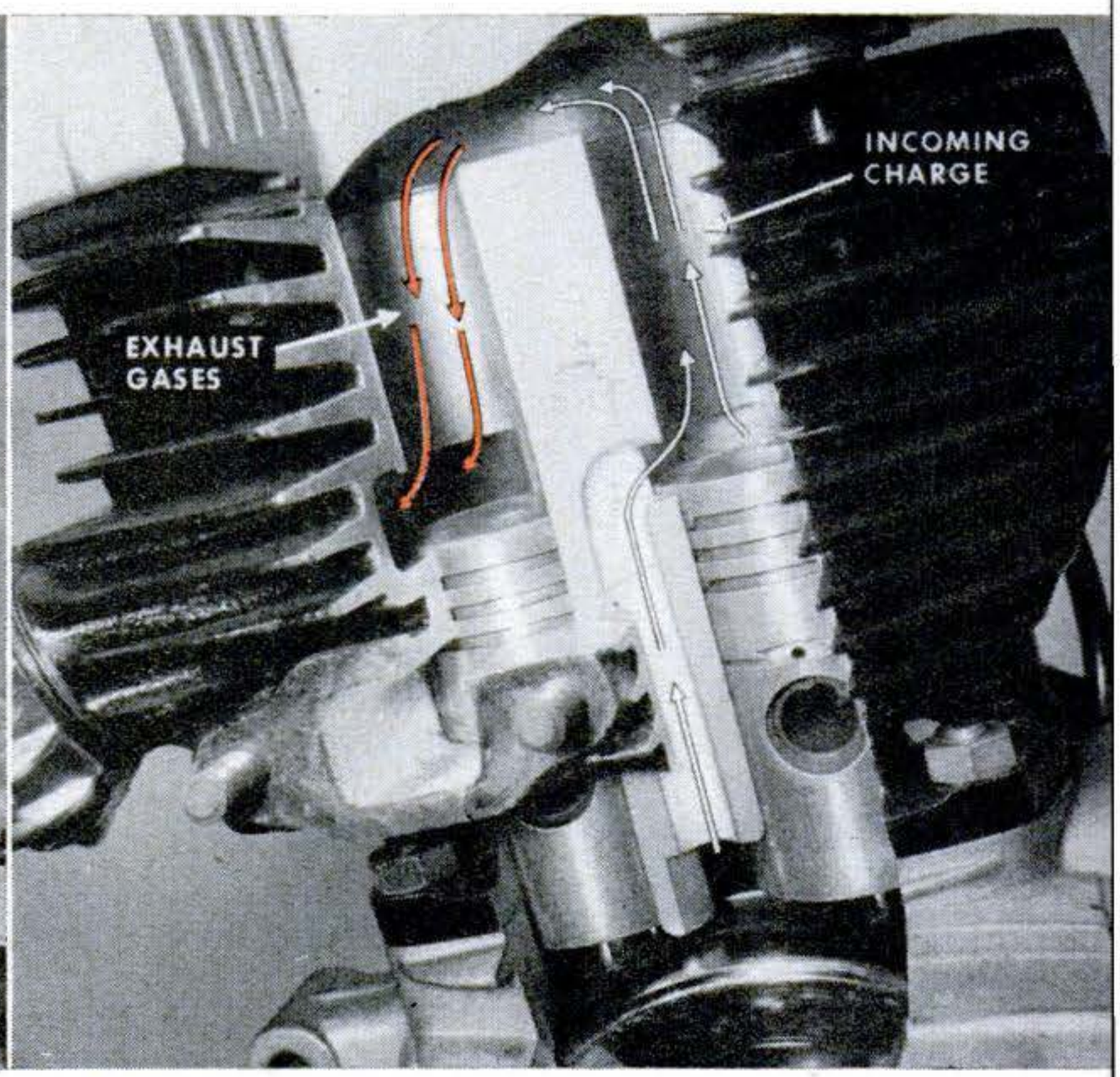
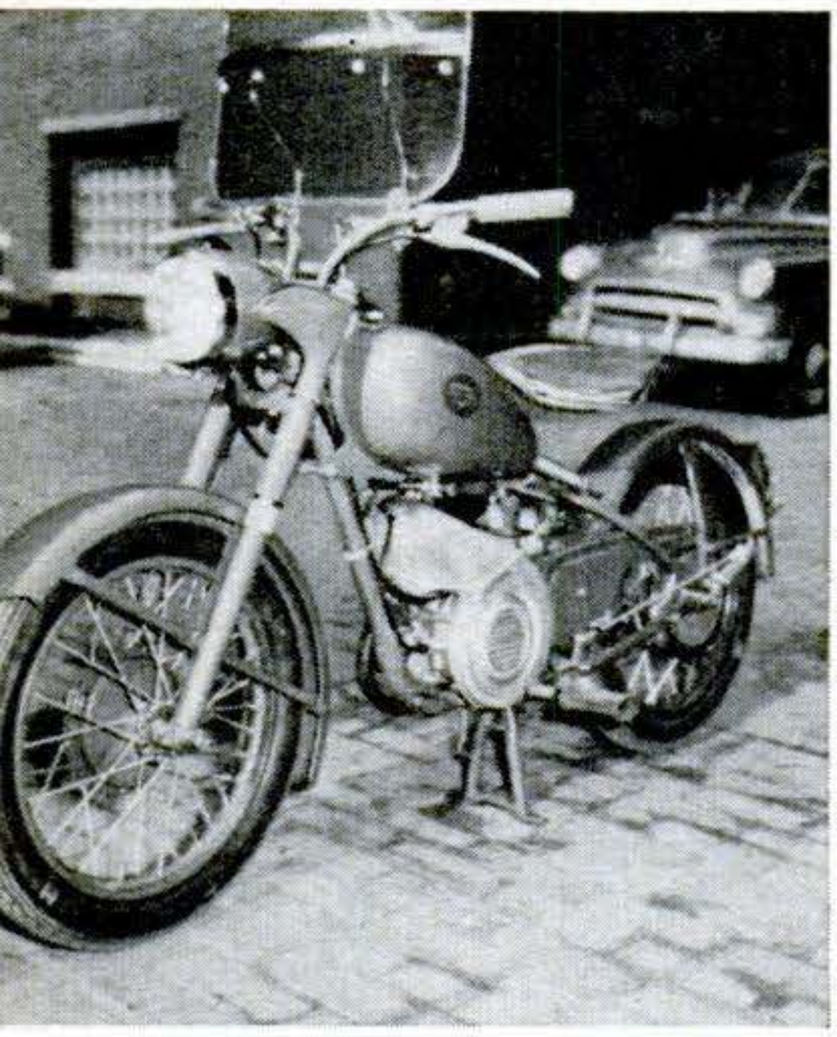
Two Pistons in One Cylinder Power Imported Cycle



PARTIAL DAM separates pistons, but they share same combustion chamber and spark plug. Cutaway shows top dead center; plug has just fired. New charge enters crankcase.



GAS FLOW at bottom dead center helps show how this two-cycle engine gains efficiency: burned gases are swept out progressively, without need for usual deflector pistons.



BABY BROTHER is this 5.1-hp., single-piston job that gives over 100 miles a gallon. A squirrel-cage blower cools it.

Ingenious engine in this small mail-order machine packs unusual punch for its size.

ANY day now you can get a motorcycle by mail and buzz across state on two or three gallons of gas.

Three new Austrian lightweights are in Sears, Roebuck's stores and catalogues this season, two in the 175-cubic-centimeter class, weighing 256 pounds dry, and a third in the 125-cc. bracket at 147.7 pounds. They are made by Steyr-Daimler-Puch, Austrian motorcycle builders, but Sears would prefer that you call them just plain Puch, pronounced *pooch*.

The bigger cycle, in either standard or de luxe trappings, will whisk you along at nearly 60 m.p.h., burn only one gallon every 86 miles, and take both you and a passenger up a 30-percent grade.

The muscle for all this comes from a 10.3-hp. double-piston engine coupled to a four-speed, sliding-

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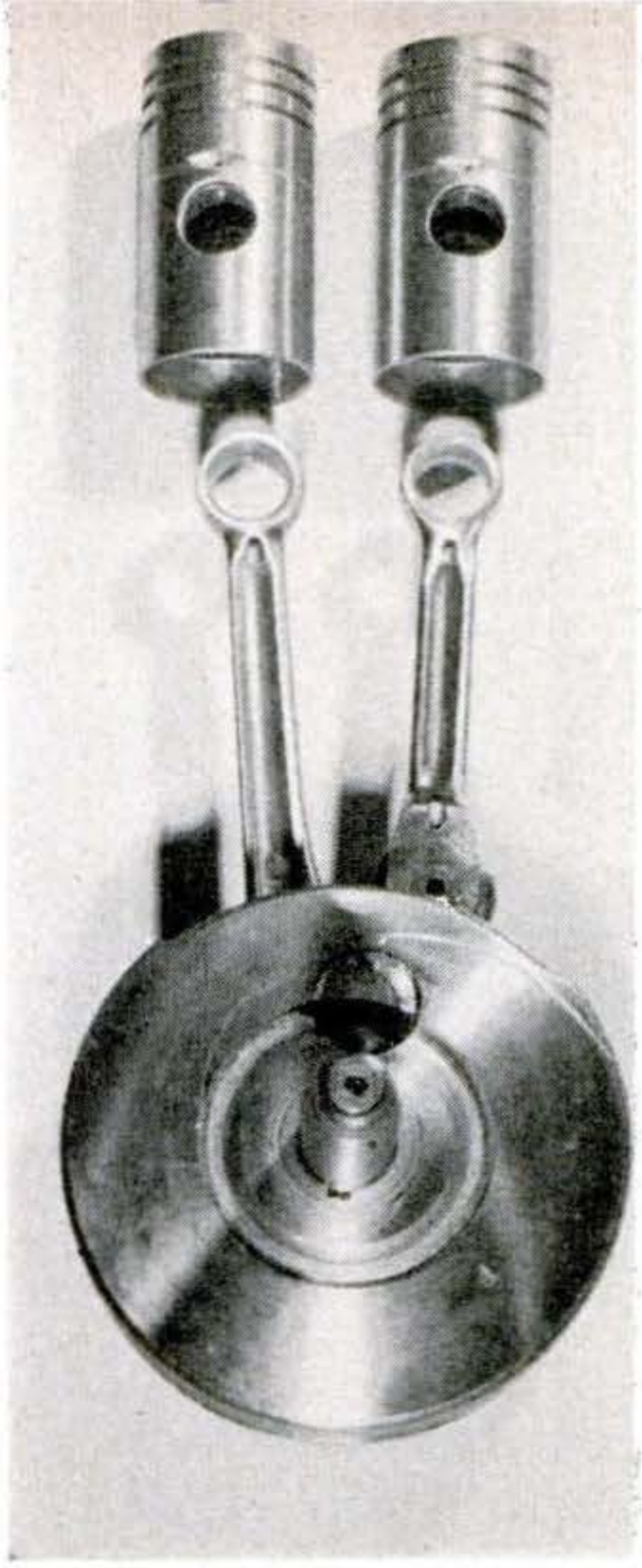
gear transmission. Its pistons work in two bores, joined at the top, that share a common finned cylinder. The intake ports feed one bore and the exhaust leads off from the other. The pistons, linked to the same crankpin, have identical strokes, but are connected so that one leads the other during part of the cycle. This provides unusually efficient scavenging of the exhaust gases. It delivers a high 0.95 horsepower for each cubic inch of displacement, almost double that of many auto engines.

Telescoping springs, oil-dampened, suspend both 16-inch wheels. Each half of the front suspension consists of a long helical spring plus an oil cylinder working through one set of damper valves. The rear fork, consisting of two shock absorbers, is a free-swinging pillar bolted to the cycle's strutless, sheet-steel frame. Almost half the rear fender is an integral part of this canopy structure.

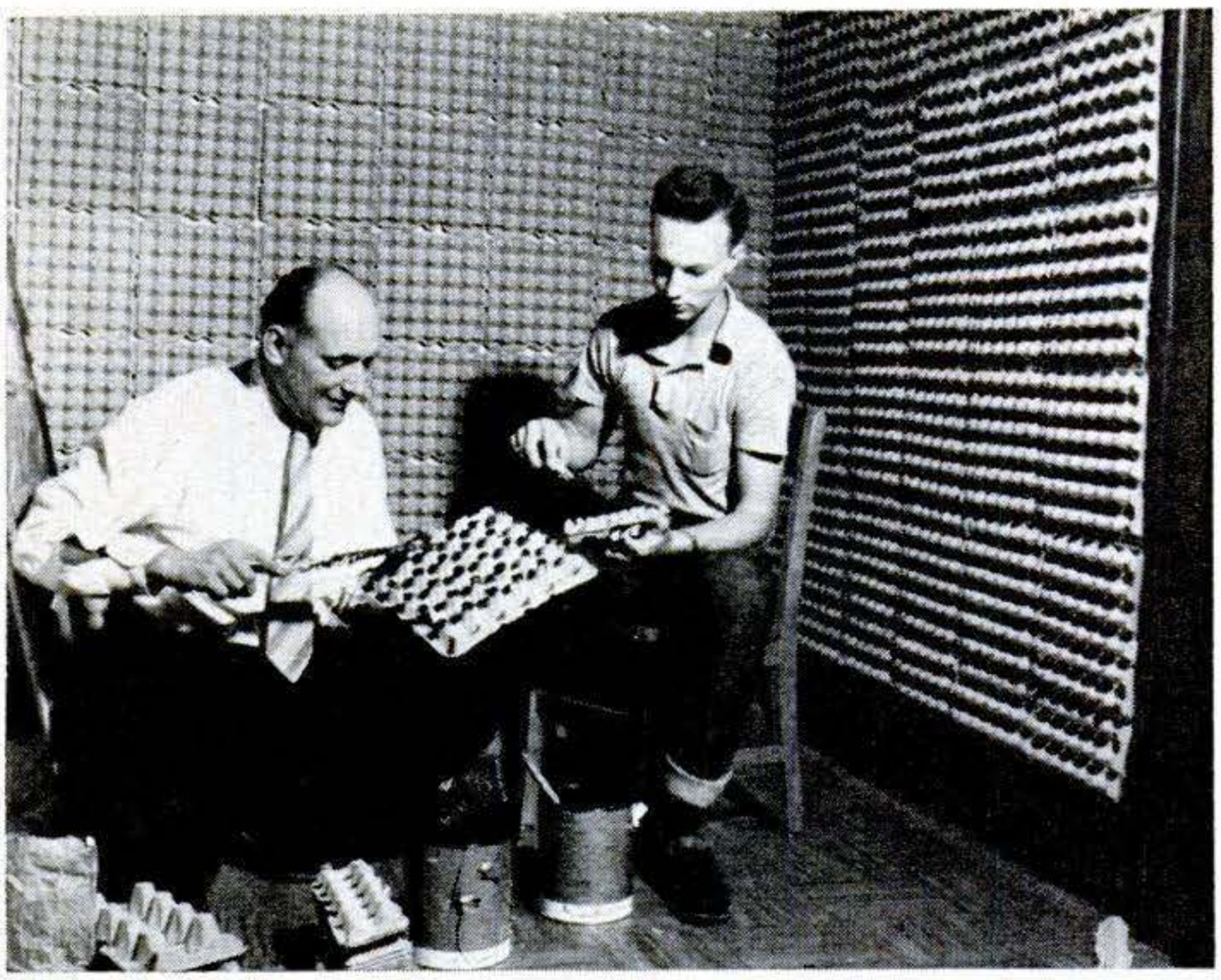
Dragging all three machines down to fast stops are oversized automotive-type brakes, finned for cooling, and applied by handle-bar grips plus foot pedals.

Sears decided to sell these small motorcycles because a motor scooter announced last year proved unexpectedly popular. The new machines will be serviced through the firm's scooter outlets. Delivered prices range from about $300 to $400.—*Kenneth Wylie.*



MAIN ROD, left, carries pivot for other. Both pistons have identical stroke but travel at different rates of speed.

To the casual eye, the new motorcycle looks like a conventional single of European design.

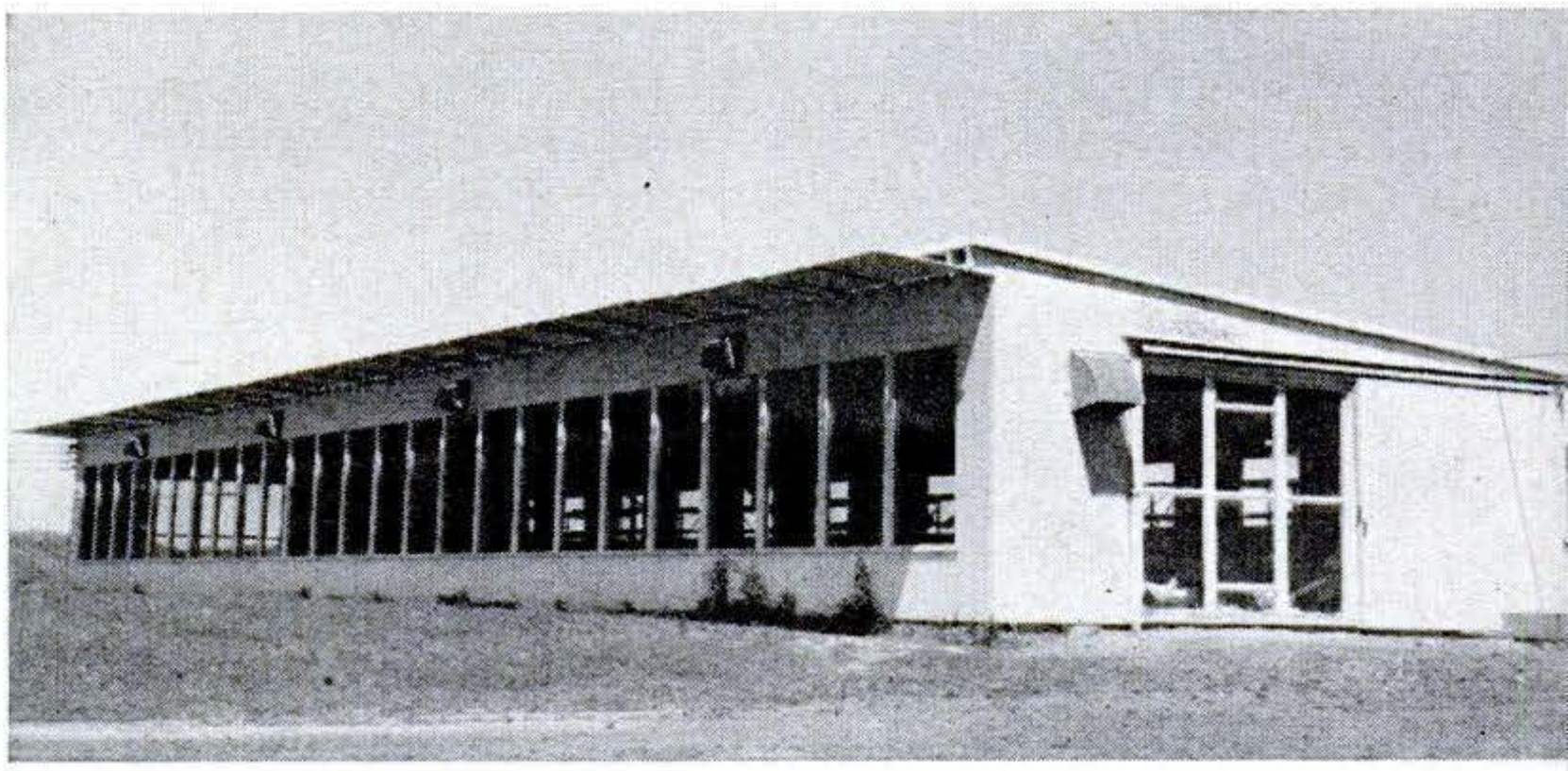


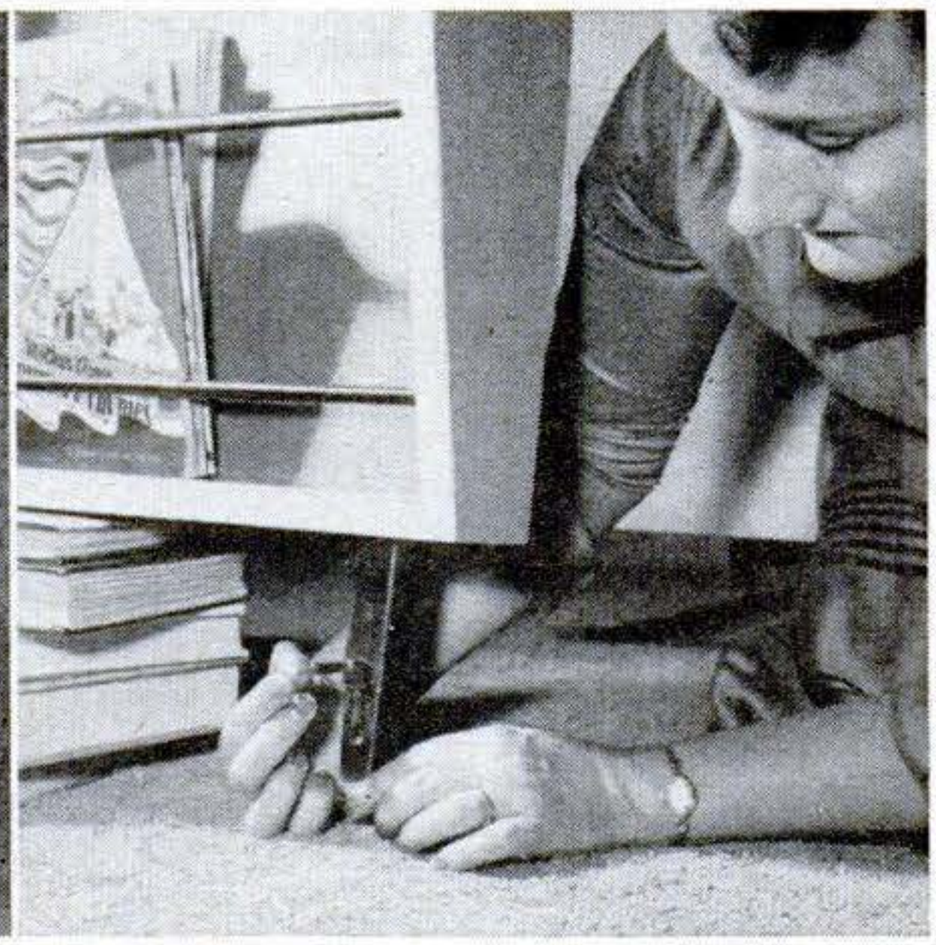
Egg-Crate Pads Quiet Radio Studio

EGG-CRATE separators line the broadcasting room at the high school in Boone, N.C. Science teachers helped by students stuck 760 molded-paper pads to walls and ceilings, then anchored them with tacks. The local radio station's engineer says the unusual acoustic treatment gives the room broadcast quality equal to that of a big station. The school studio hooks up with station WTAR in Boone.

Educated Chickens Live in Solar House

THIS window-wall house is strictly for the birds. Facing south at Penn State's experimental farm, its Thermopane windows keep poultry warmer in winter, cooler in summer. An overhanging sunshade (shown extended) keeps direct rays from the double panes in hot weather.





This Furniture Grows Taller as Junior's Legs Grow Longer

THE combination desk and chest above grows with your child. To raise the level of the writing surface, you just pull out the telescoping iron legs and reset the locking pins (right, above). Three dresser drawers at one end of the desk are topped with a cabinet with removable shelves and a built-in clothes rod. A magazine rack forms the other pedestal. The Darbylite Corp., 467 Troutman St., Brooklyn, N.Y., is the maker.

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British Fire Fighters Use Gas-Turbine Pump

Two men can cart this gas turbine around a plant for use as an engine or a pump. It needs no water, little lubricating oil, and is far from choosy about its fuel. It will run on natural gas, coal gas, sewage gas, gas from a blast furnace, as well as kerosene or gasoline.

Operating as a water pump, it can deliver 500 gallons a minute at 100 pounds' pressure. The Rover Co. of Coventry, England, maker of one of the first gas-turbine automobiles, is the designer.

▶▶▶The kids couldn't be left home with Mama during a recent scientific meeting in Washington—it was the annual convention of the Society of Women Engineers. The children came along and played in a hotel nursery while their mothers met in rooms nearby, glancing in occasionally to check on their offspring.

Twin Trailers Link Up to Make a 100-Seat Auditorium on Wheels

When its merchandising men tour the country, one company now sends along a showroom aboard two trailers that open and unfold to make a big auditorium. The facing trailer sides swing out and lock to form an interior that seats 100 persons. Tucked in corners and on walls are a projection booth, three movie screens, a loudspeaker system and spotlights. Boyertown trailers make up the Armstrong motorcade.

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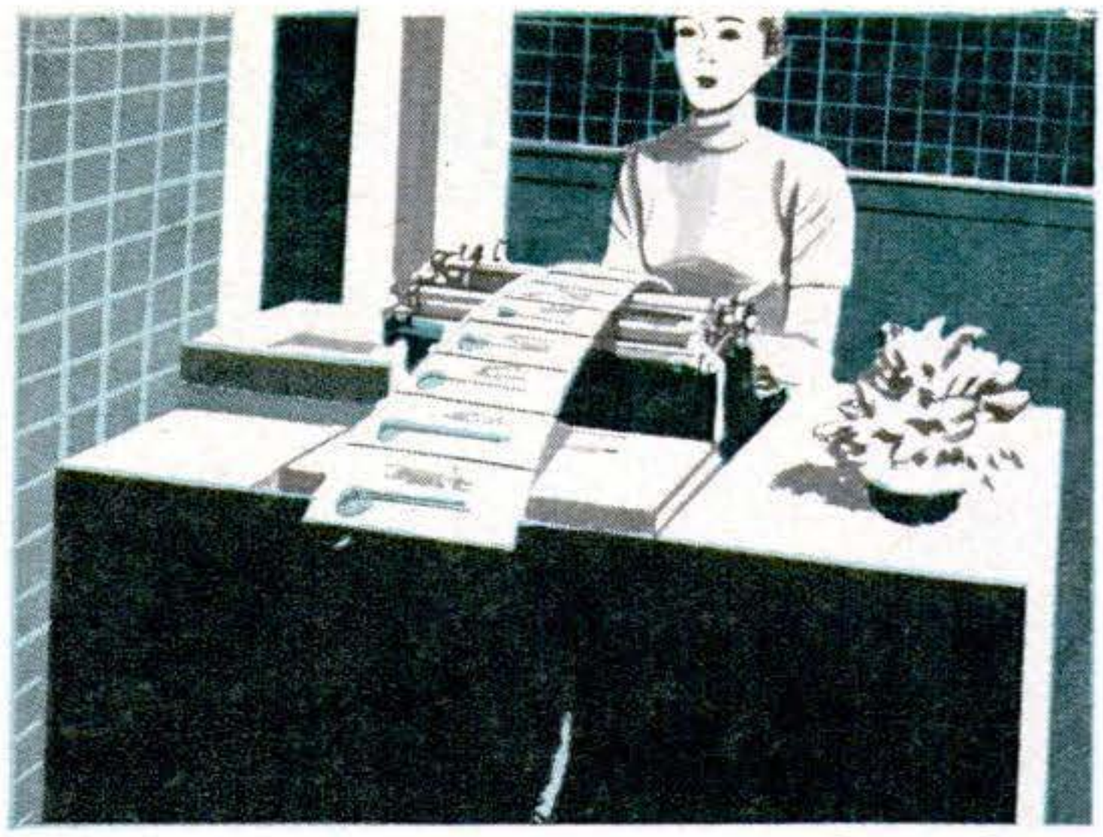
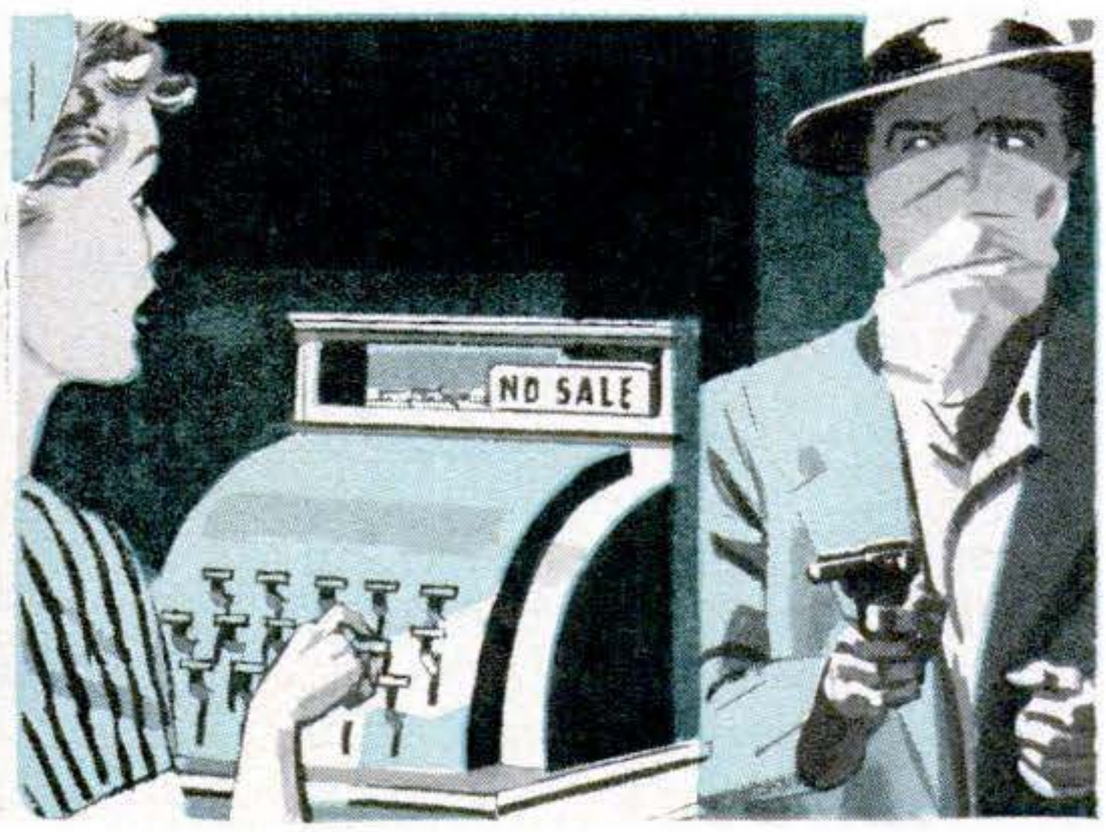
I'd Like to see them make...

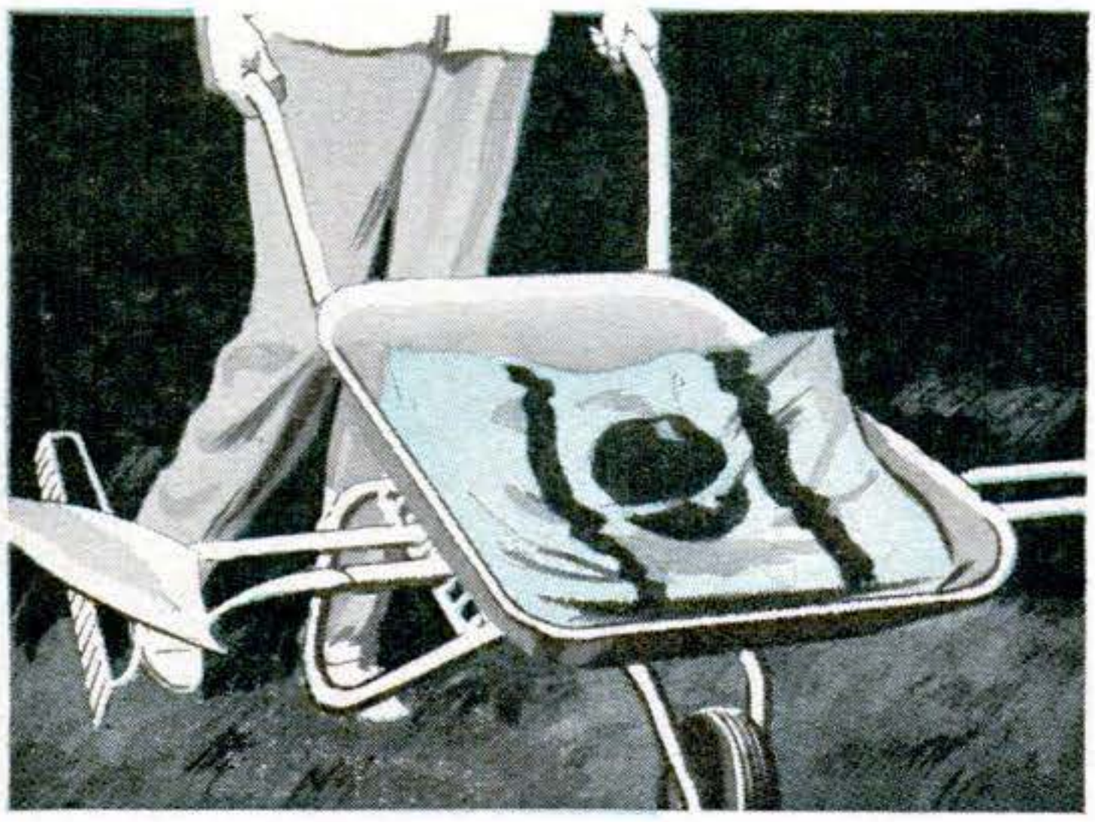


GOVERNMENT POSTCARDS printed in long strips and perforated so they could be torn apart for mailing. Typing notices would be quicker.—*Mrs. Joyce Mosby, Darby, Pa.*

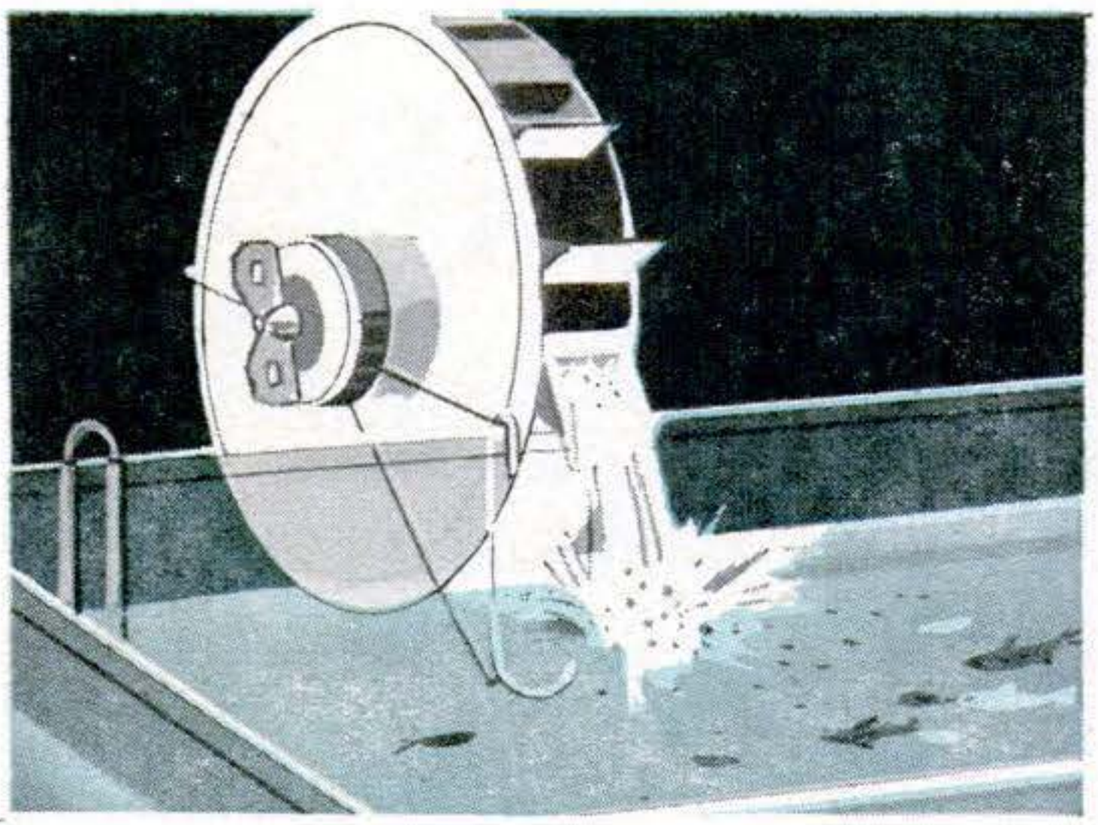
CANNED GASOLINE, sold in sealed gallon tins like antifreeze. Two or three could be carried safely in a car trunk for emergency use.—*Frederic Carroll, Dallas.*



A CASH REGISTER with a special key that would ring up NO SALE and at the same time set off a burglar alarm at a protective agency.—*Murray Sidlin, Baltimore.*



A DOUBLE-DECKER WHEELBARROW. The lower deck could be a shallow tray or a rack for tools, leaving the upper deck clear for materials.—*Robert Chambers, Hewitt, N.J.*



AN AQUARIUM FISH FEEDER that would do a catering job when you were on vacation. A bucket wheel with timer could dump food at preset hours.—*P. Hoff, McKees Rocks, Pa.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by *Popular Science Monthly* readers. What is *yours?* We will pay $5 for each one published. Please use government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

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Elongated Turbojet for Record-Breaking Fighter Is Unveiled

THIS long hunk of machinery is what sped the F-100 Super Sabre to a world speed record of 755 m.p.h. It is the J-57 turbojet, shown in one of the first photos released. The Pratt & Whitney power plant provides added power from its afterburner, an exhaust extension that can burn extra fuel when the pilot needs a boost in thrust.

L. A. Ready with Radio Trailers

LOS ANGELES has three of these trailer-mounted communications centers for civil defense. They tie in with 150 radio cars, 100 walkie-talkies and 60 fixed bases. A "pup trailer" hauls a generator to power equipment in the big Fruehauf trailers.

Truck Makes It Rain—a Little

THE rainmaking truck above helps show which kinds of pasture will soak up rain the best. The cylindrical structure sprinkles two-foot patches of land so that Department of Agriculture scientists can compare different types of soil and grass.

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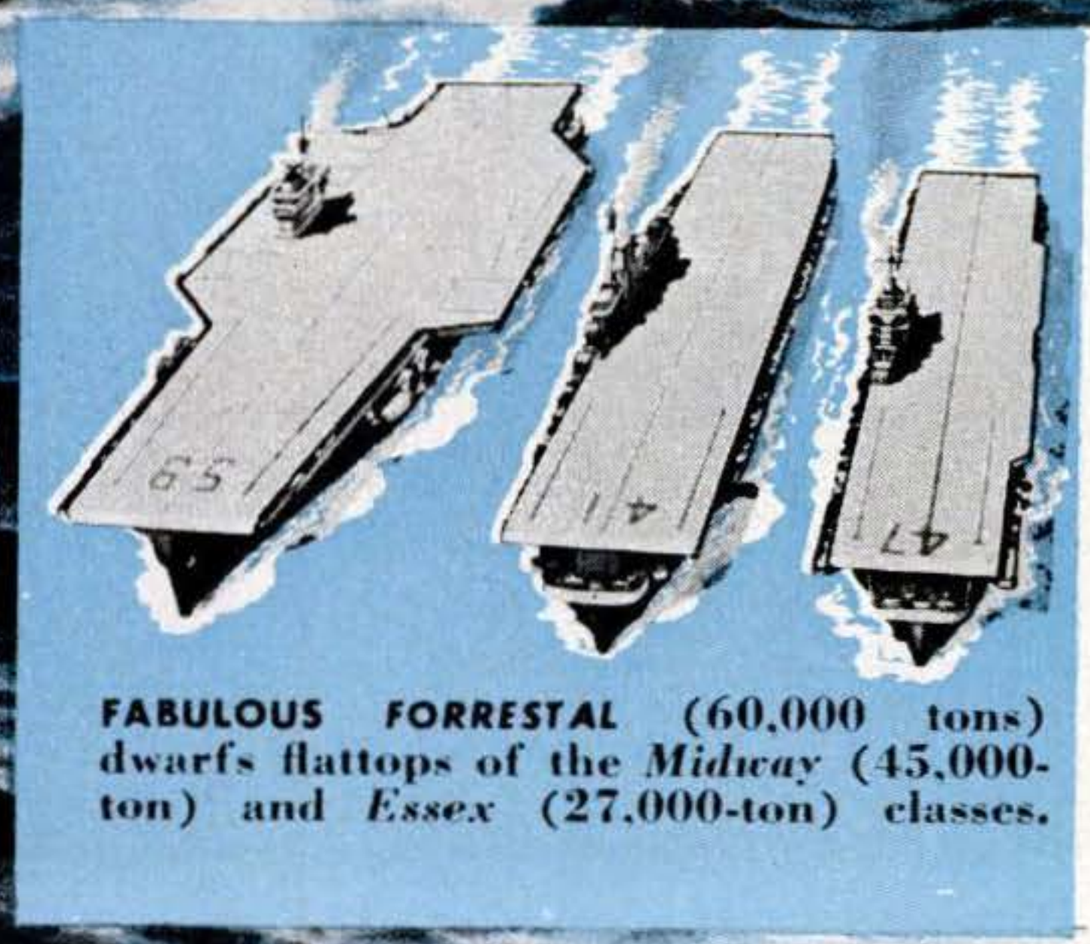
The U.S. will soon launch the

Biggest Ship Ever Built

Under a steel-plate flight deck five city blocks long, the giant aircraft carrier* Forrestal *packs a $217,000,000 punch.

By Henry B. Comstock



FABULOUS FORRESTAL (60,000 tons) dwarfs flattops of the *Midway* (45,000-ton) and *Essex* (27,000-ton) classes.

THE USS *Forrestal*, the world's greatest single investment in seaborne striking power, will be backed out of a graving dock into the James River at Newport News, Va., this fall.

Sixteen thousand engineers, draftsmen and builders have worked on her, and $217,000,000 has been invested in her.

Now the great ship fans out over her dock like an A-bomb's mushroom molded in steel. She has the same impersonal killer-look—a bare-stage ugliness that gives your imagination plenty of runway. More than a city block wide

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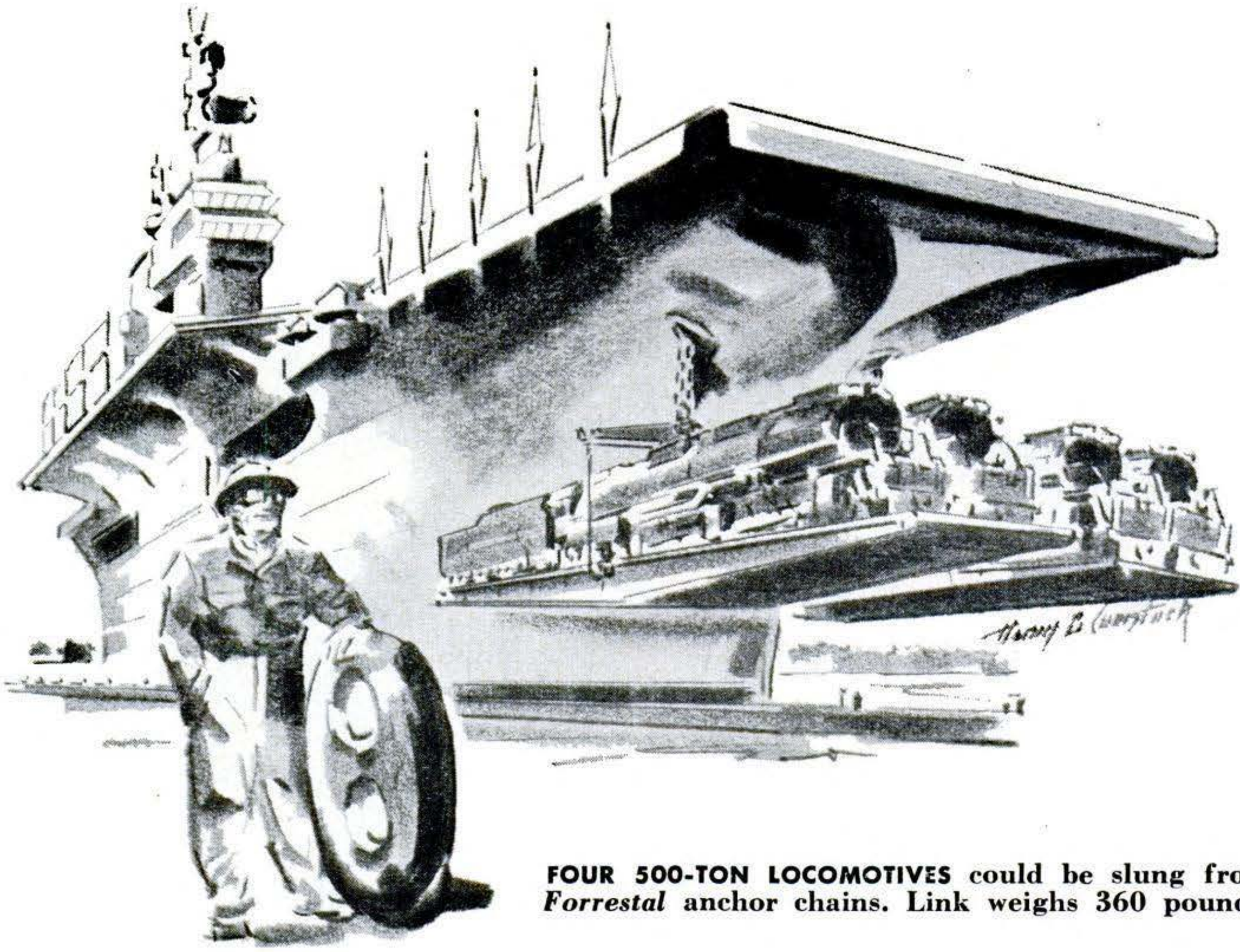


FOUR 500-TON LOCOMOTIVES could be slung from *Forrestal* anchor chains. Link weighs 360 pounds.

(252 feet at her flight deck) and 1,039 feet long, she is only seven feet shorter than the Chrysler Building is high.

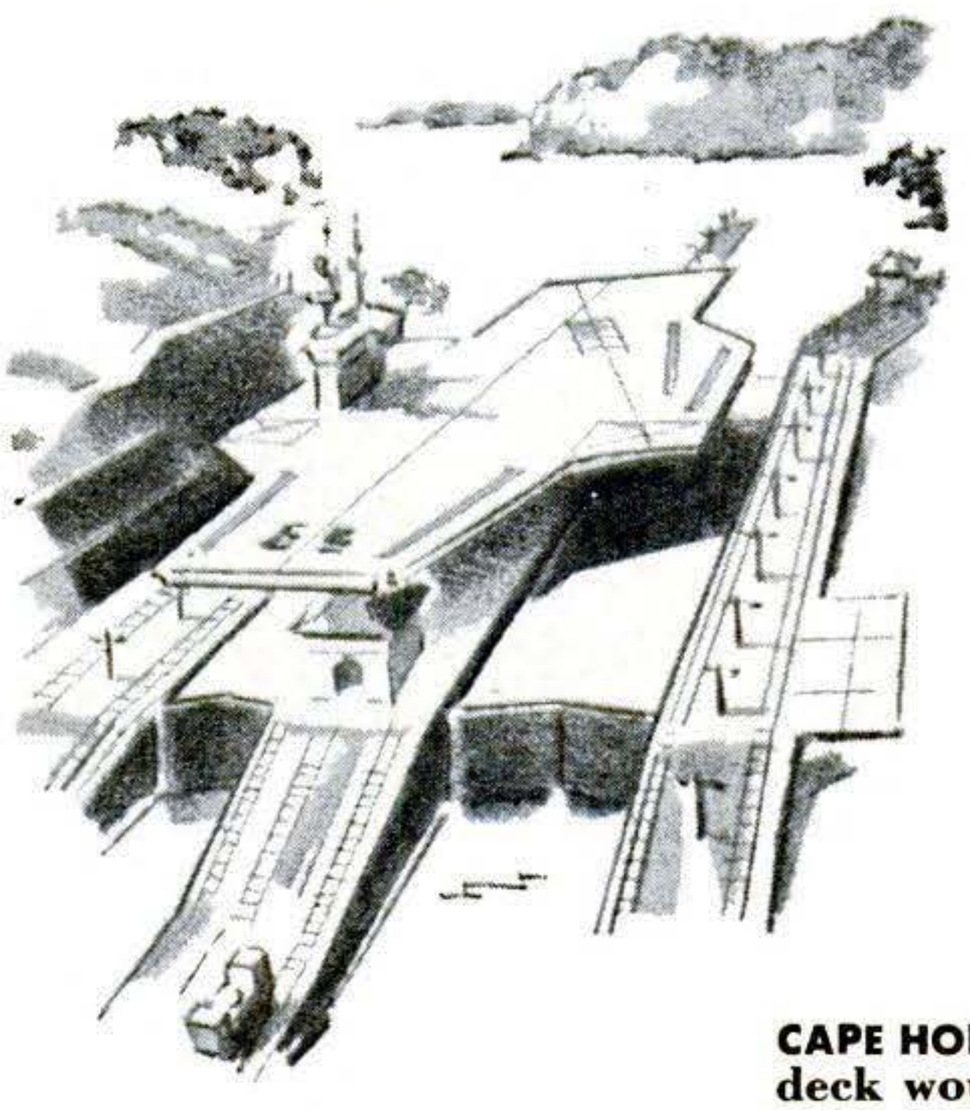
Picture 100 *Santa Marias* moored bowsprit-to-sternpost and portside-to-starboard in the form of an elongated cross. Remove the *Forrestal's* control island and you could stow the lot of them aboard her flying deck.

Or stand on the edge of that floating airfield and look down. The floor of Graving Dock 12 is almost a hundred feet below you. But you'd never guess it. This huge concrete basin, which could wrap up such luxury liners as the *United States* with ease, is now blanked out by a hull that's busting out all over.

Cranes Trapped by Ship's Bulk

They had to clear Dock 11, beside her, to make way for the sponsons that support her flight deck. And the big traveling cranes that lifted 80-ton prefab assemblies aboard for welding are now trapped at the land end of their own handiwork. Crawler-cranes on the *Forrestal* herself must handle the control-island units.

That island will be five decks high. With its stubby, hinged masts raised, it would tower 60 feet above the underflooring of the Brooklyn Bridge. A full-scale mock-up of each deck was roughed



CAPE HORN DETOUR awaits *Forrestal*—its flight deck would span Panama Canal's twin locks.

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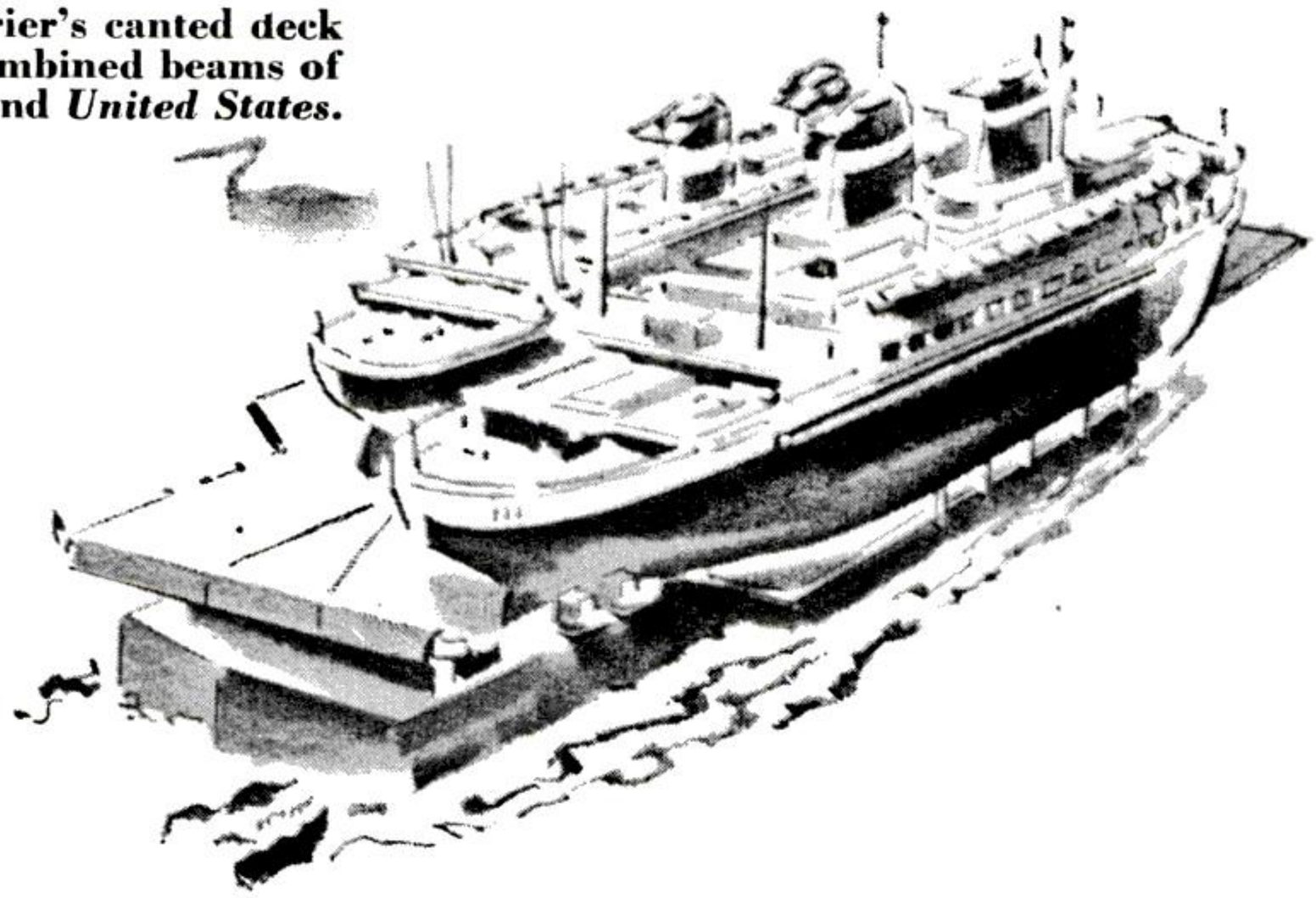
OVER-ALL WIDTH of the carrier's canted deck is 58 feet more than the combined beams of the luxury liners *America* and *United States.*



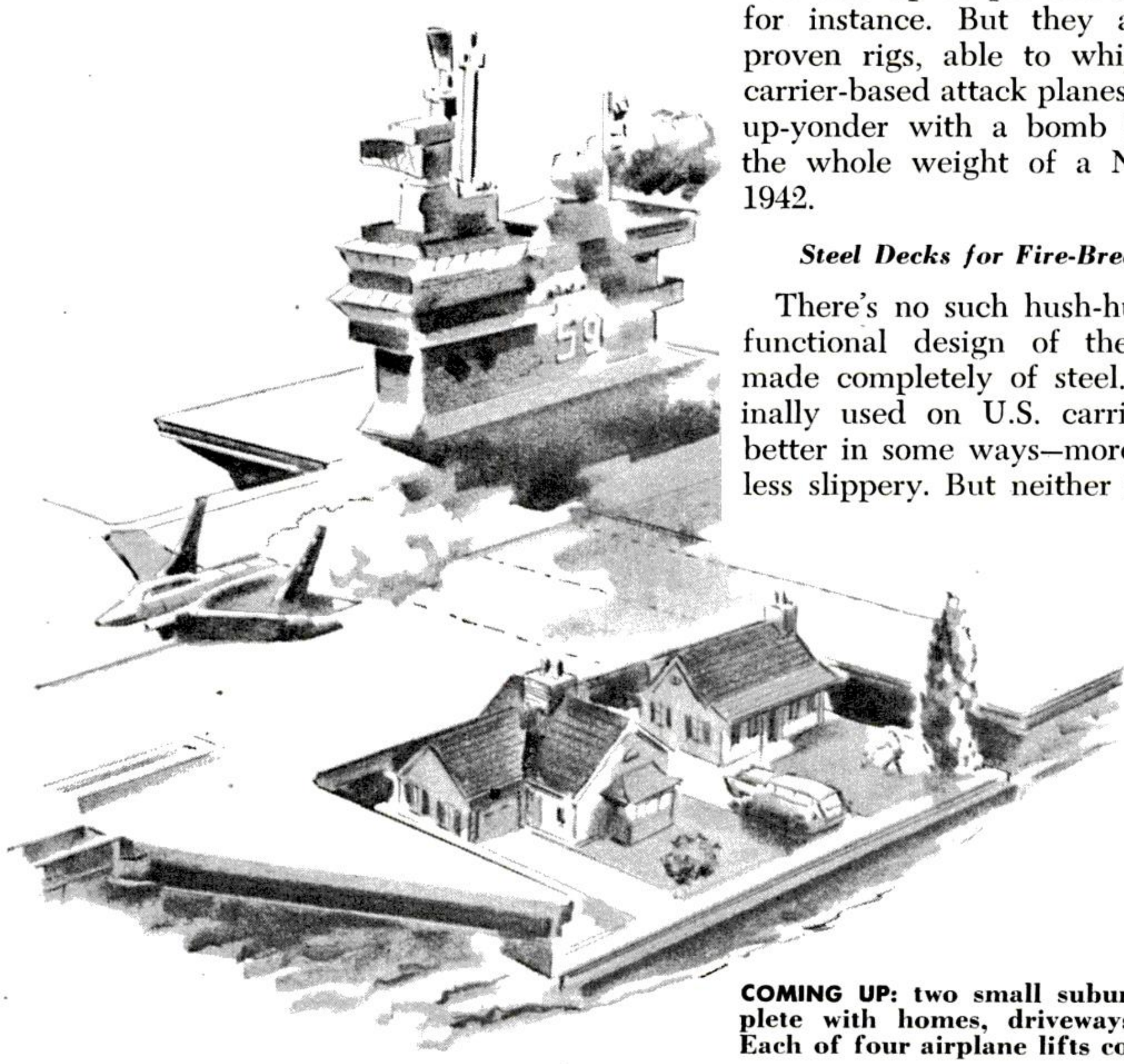
out in the shipyard's joiner shop before cutting torches went to work on girders and sheet steel. Except for soundproofing, these mock-ups are complete, down to the last simulated intercom phone. An unimportant detail? Not when you're plotting cable for 400 dial sets and 1,900 sound-powered battle telephones aboard the ship.

Looking out through the pagoda-like windows of the primary flight-control mock-up, you can almost trace the blur of A3Ds streaking down the four long ribbons on the deck that will be the only visible sign of the *Forrestal's* steam catapults.

The Navy is coy about those "cats." Nobody's saying how the grooves are buttoned up to prevent steam leakage, for instance. But they are tried and proven rigs, able to whip the biggest carrier-based attack planes into the blue-up-yonder with a bomb load equal to the whole weight of a Navy plane in 1942.

Steel Decks for Fire-Breathing Jets

There's no such hush-hush about the functional design of the deck. It is made completely of steel. The fir originally used on U.S. carrier decks was better in some ways—more resilient and less slippery. But neither fir nor experi-



COMING UP: two small suburban lots, complete with homes, driveways, landscaping. Each of four airplane lifts could hold them.

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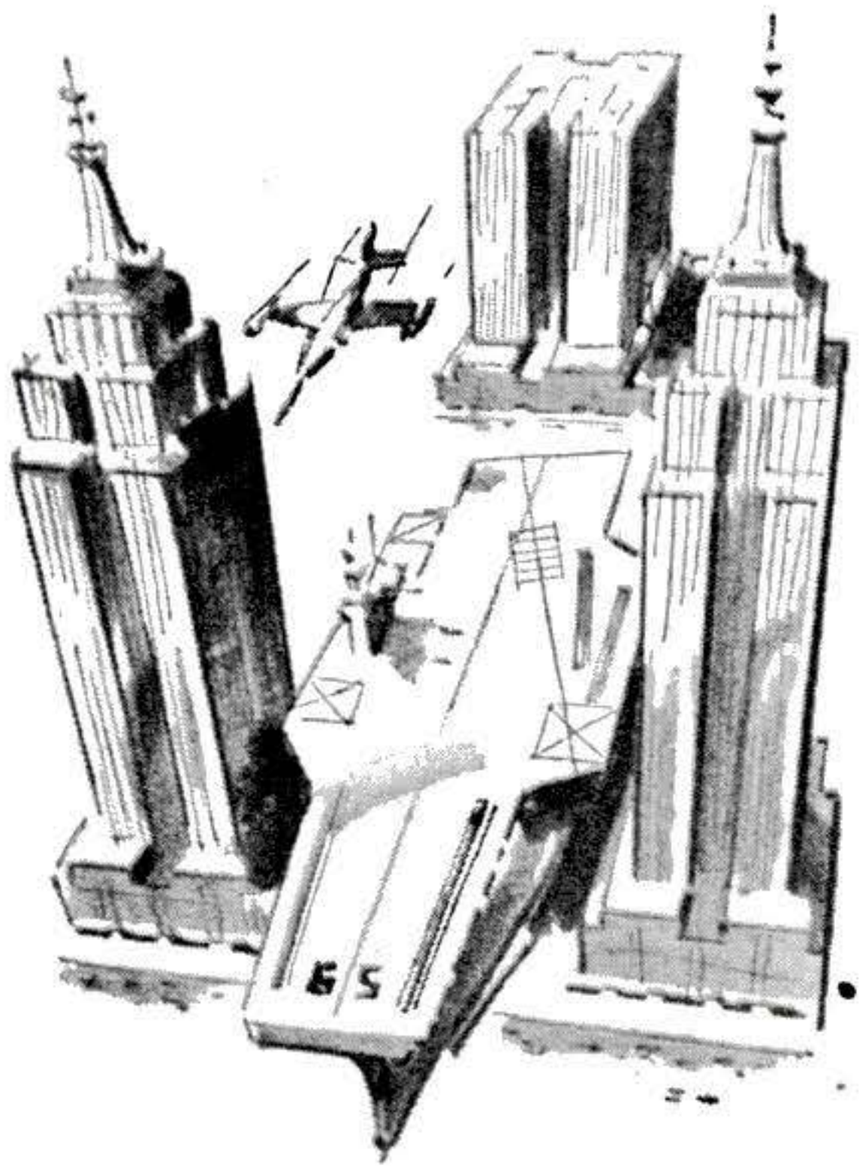
mental teakwood could take the hot breath of jet afterburners. The *Forrestal's* "tin roof" can. What's more, it will turn a kamikaze into the kind of briquette you can sweep up with a broom.

The carrier's amazing overhang is the direct result of the Navy's success with a canted deck on the flattop *Antietam.* In the past, an inbound plane that had lost its flying speed and missed the arresting gear on the aftersection of the deck, plowed into a protective barrier if other planes were parked up forward.

Now that hazard is gone. They've widened the mid-section of the *Forrestal's* deck, and set her landing strip on a 10.5-degree diagonal. Thus a plane whose hook fails to engage any of the six hydraulically cushioned pendants (cables) strung across the runway will have a clear track over the portside of the ship and out to sea again, where it can square off for another try.

The canted deck has other advantages. The old axial, or center-line runway is still in business up front, offering what amounts to a completely independent airstrip. With catapults on both runways, the *Forrestal* will be able to toss her big jets aloft with the dexterity of a juggler, cutting the launching time for her squadrons in half. Or she can, when necessary, launch one flight and recover another at the same time.



ENOUGH AIR-CONDITIONING EQUIPMENT for 2½ Empire State Buildings will blast tropic heat from crew quarters and most working space for comfort aboard the *Forrestal.*

Dumb-Waiters Will Serve Up Planes

The platform overhang also puts her four big aircraft elevators where they belong—out on the edge of the deck—not in the middle of her runways. These oversize dumb-waiters will shuttle between the platform and three 25-foot-high hangar bays on the deck below it.

The huge proportions of the bays—you could put five basketball courts in any one of them—are typical of the *Forrestal's* dimensions.

Her 3,500 crewmen will use nearly twice as much water as the eight big boilers that feed her main turbines. To supply both needs, her water tanks must store nearly 400,000 gallons. Half of it will pass through her distillers, daily.

Although one man can operate all of the control devices in each of her machinery rooms, the *Forrestal's* power plants are the largest ever put in a ship. To carry 200,000 horsepower from the turbines back to the screws, machinists at Newport News turned the world's biggest shafts. The longest of the lot has a reach of 400 feet. Each of the five-bladed bronze propellers is 22 feet in diameter. They will fan the *Forrestal* along at better than 30 knots.

Your guess is as good as any layman's when it comes to speculating on her secret weapons and special equipment. At Newport News they'll only tell you what your own eyes can see—that turrets for five-inch guns are not yet outmoded.

Those who say that the H-bomb has written "finis" to big ships like the *Forrestal* like to use the phrase "too many eggs in one basket."

The men who designed the *Forrestal,* and two sister ships to follow (the *Saratoga* and *CVA-61,* as yet unnamed) have a pat answer.

"There'll be plenty of eggs," they agree. "The kind that a basket like the *Forrestal* may be able to protect and deliver better than a land-based setting hen." END

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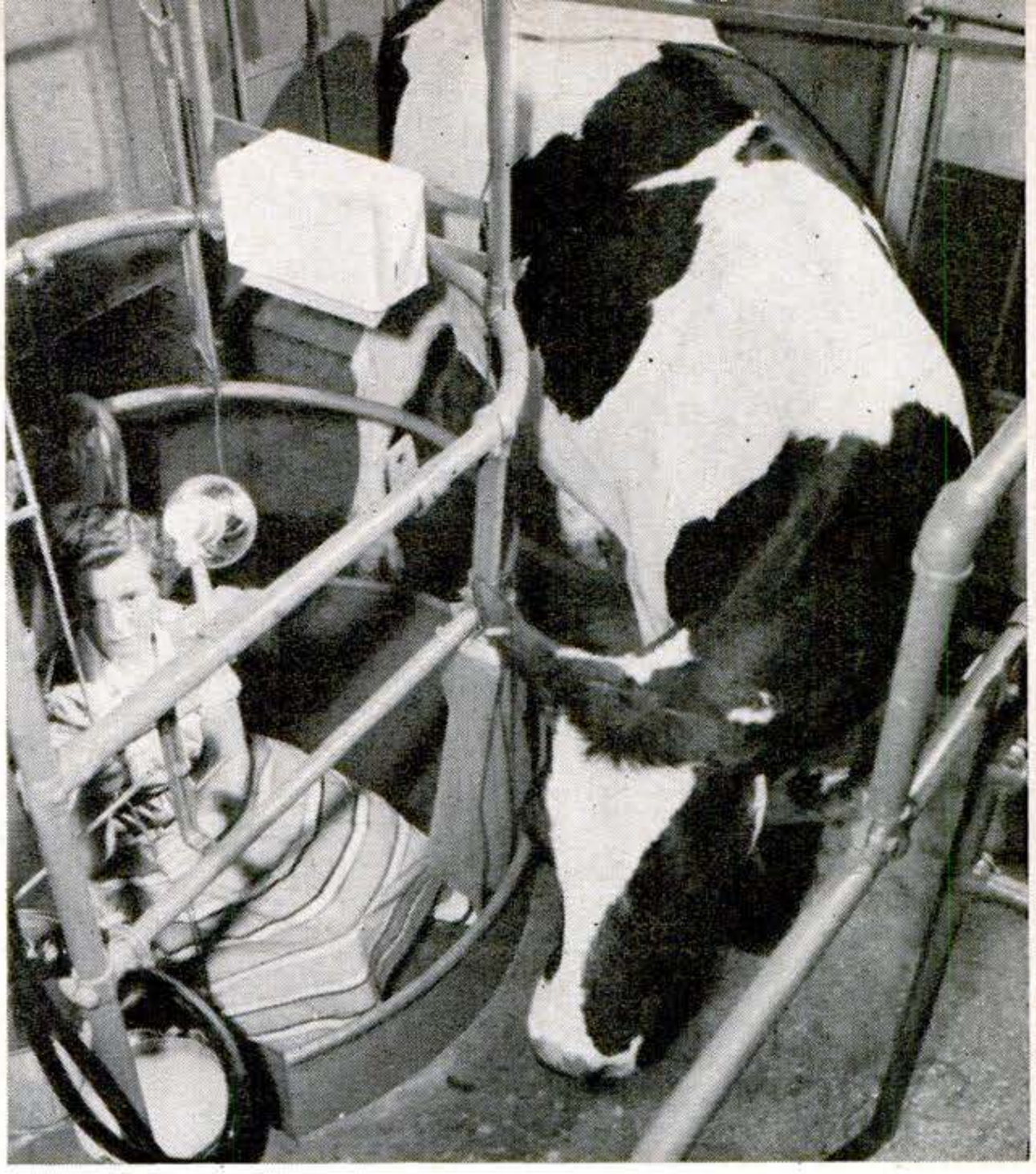
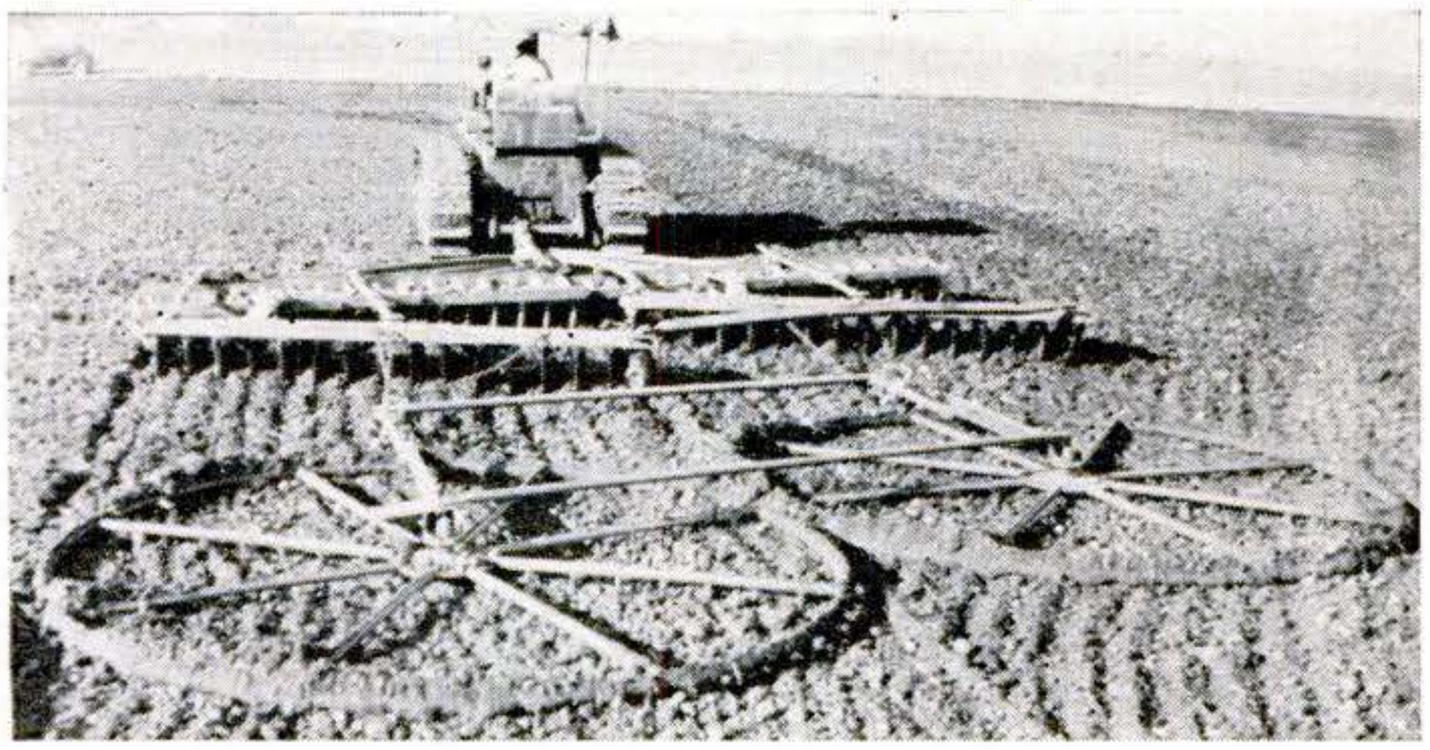
Safety Belt Stops Tractor

IF THIS farmer falls off his tractor—a common, often fatal accident—he won't get plowed up. His fall will yank out of his belt a plug wired to the ignition, killing the engine and stopping the tractor. The Dooley Co. of Moline, Ill., manufactures the safety belt.



Dairymaid Milks from Swivel Chair

MILKING 30 cows an hour without moving is easy for this dairymaid. The cows walk around her while she swivels about in the pit to milk, clean or feed them as they move along. Hervey Research Development Corp., Geneva, Ill., makes the equipment.



Gigantic Eggbeater Harrows Soil

GIANT rotating wheels dig slanting teeth into the soil to harrow and level fields at the E. S. Thompson ranch at Strathmore, Calif. The teeth, welded to the tubular framework, make the tool rotate as it moves forward.

Hens Get Quick Snack from Hopper on Jeep

SCOTT PEACOCK of Dinuba, Calif., doles out meals from a jeep-mounted hopper to feed 4,500 chickens in 4,500 cages in less than a half-hour. A gasoline-powered auger pushes feed across the bin and a paddle elevator lifts it to a flow spout. A strap on the driver's leg controls a clutch that regulates flow to the feed troughs.

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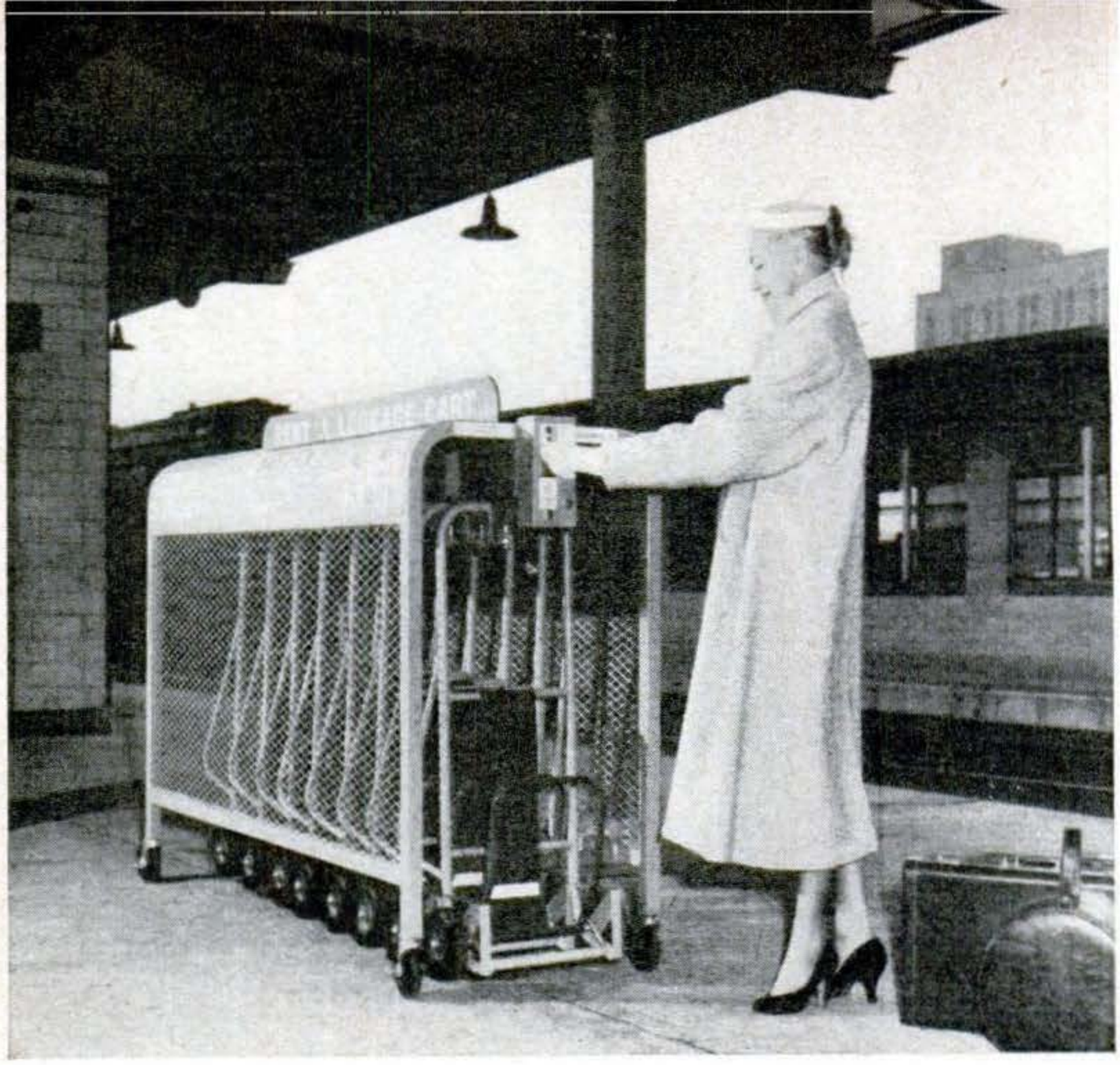


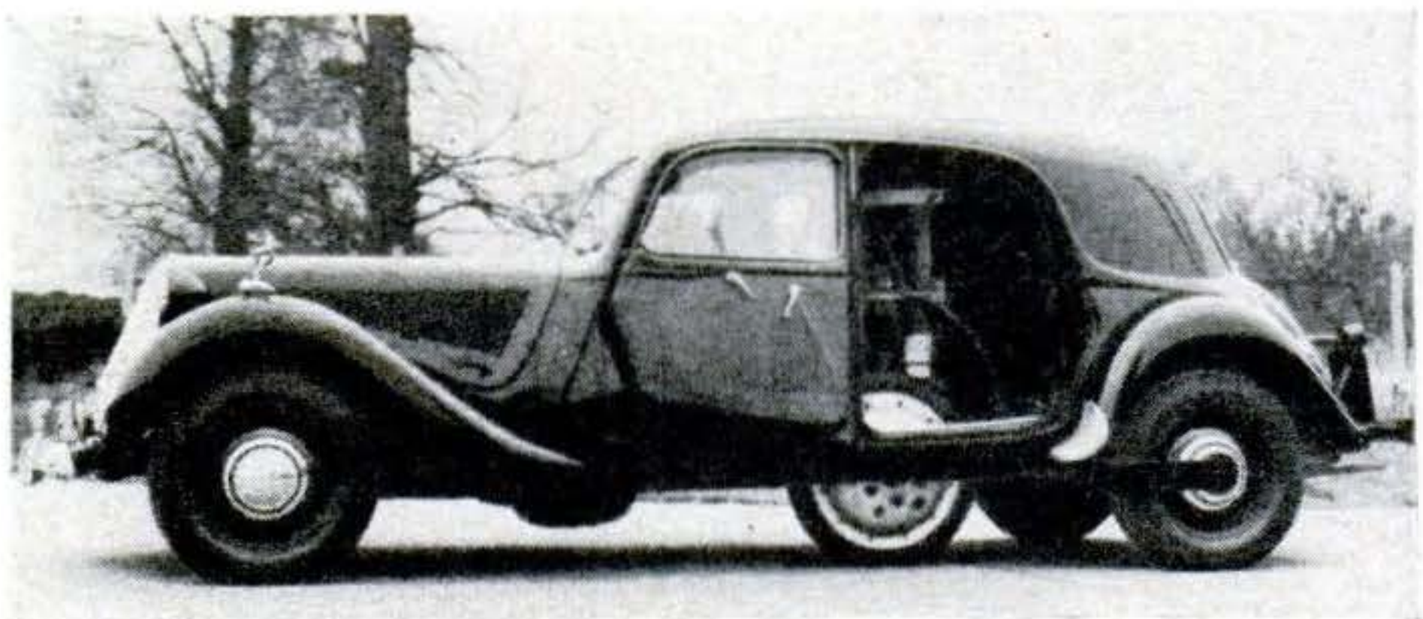
Slot Machine Rents Cart as Robot Redcap

BY DROPPING a quarter in a slot, this young lady gets a baggage cart for the hike from train to taxi. At the station exit she'll park the cart in another rack and get a refund of 10 cents.

Two railroads are trying out the self-service carts to supplement redcaps at Boston's South Station and at Penn Station in Pittsburgh.

Car Skids on Purpose to Make Roads Better

THAT fifth wheel helps British engineers measure skids while their car goes straight and true. The extra wheel is simply mounted at an angle, so that it is always skidding. It is used in experiments on skid-resisting road surfaces.



Tin-Can Phonograph Sells Oil

NEXT time you stop for gas you may be handed a talking can to hold while you wait. A tiny phonograph run on flashlight batteries, it is set off by a button and sounds off with a sales pitch for Permalube oil through a speaker in the bottom.

Quick Camera Gets Smaller

HERE'S a squeezed-down model of the camera that prints its own film as you shoot. Coat-pocket size, the new Polaroid makes eight 2¾-by-3½-inch pictures from a roll that costs $1.19. The camera costs about $70, the clip-on flash gun $13.

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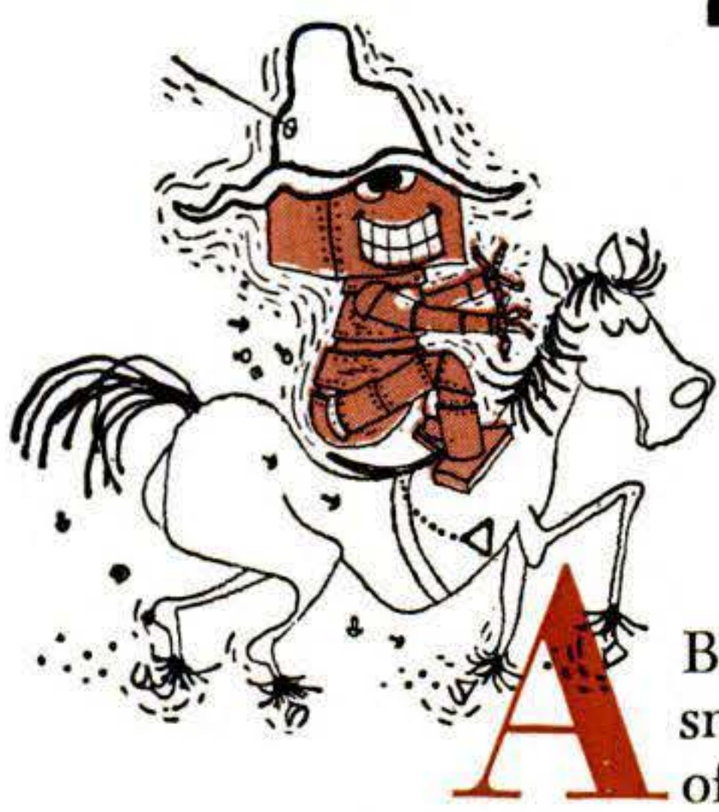
Let's Put Some Science in Science-Fiction



Well-known science writer prods modern cosmic yarn-spinners in the seats of their space suits with some pointed pointers.

By John Lear

A BESPECTACLED small-fry inhabitant of a daily newspaper comic strip recently appeared in print with his head embubbled in a space helmet and a ray gun clutched in his hand.

"Seen any bad men in th' gulch today?" he inquired of a female caricature. "I aims to put law and order in these here parts!"

"You're mixed up, Stuart," the gal retorted. "You're dressed like a space-man, but you talk like a *Westerner!*"

The self-appointed spokesman of order stiffened his neck.

"It so happens, ma'am," he cried, waving his pistol, "that I'm from out yonder in WEST MARS!"

The cartoonist who sketched that episode must be a reader of science-fiction. Certainly he achieved, in a few deft strokes, the most succinct expression I have seen or heard of the state of literary schizophrenia in which SF writing is bogged today.

On TV, Captain Video's space rangers amuse themselves, while riding rockets between the planets, by dialing movies of the Old West on their remote carrier beams. Perhaps this unscientific

JOHN LEAR, the writer of this article, holds four top awards for excellence as a science reporter: the Sigma Delta Chi Award for distinguished public service, the Headliner's Award, the Westinghouse Award of the American Association for the Advancement of Science, and the Albert Lasker Award for distinguished writing in medical journalism.

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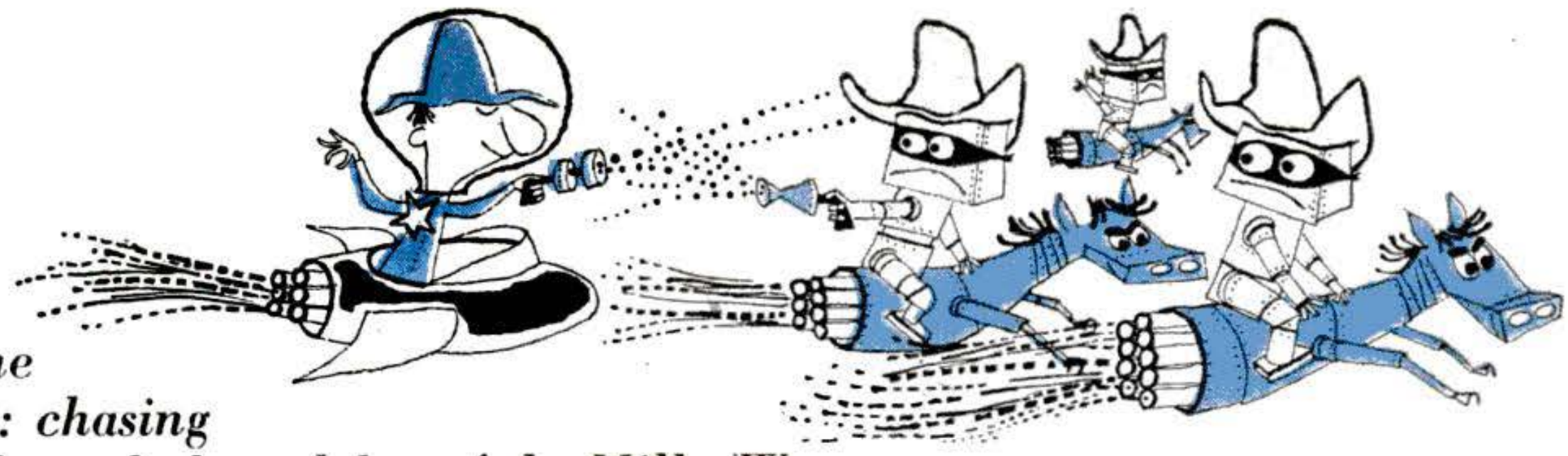


Space-time sandwich: chasing rustlers through the gulches of the Milky Way

sandwich of space-time may be excused on the ground that the earthbound watchers of the show are kids. But what about the following supposedly grownup book review in *The New York Times*? I quote verbatim:

> The Earth of the far future is plagued with many problems: what to do about its conquerors, the "Spacers," descendants of the men who settled the stars; where to employ people thrown out of work by robots; why mankind prefers to live in a few gigantic megalopoles; and how to discover the murderer of an eminent Spacer. It is with this last problem that Lije Bailey, detective, is concerned. If he fails, he loses his rating, an almost-fatal misfortune in his overcrowded world. Moreover, he must cooperate with a robot Spacer detective while solving the crime. Lije learns more than the identity of the murderer: he learns how Earth can save itself.

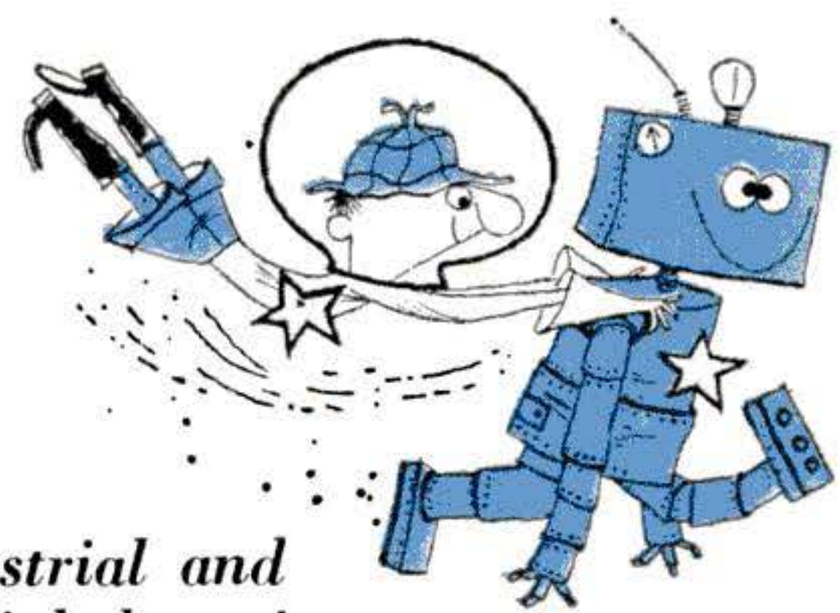
Is Lije Bailey very likely to make such a sweeping discovery while chasing a murderer? Does the writer who concocted such a plot show any respect for the scientific method of inquiry? How in the name of all the galaxies can any logical brain misuse the word "science" by calling Lije's Hollywood nightmare science-fiction?

SF Editors Repelled by Own Vacuum

I would enjoy, and I am sure most readers of POPULAR SCIENCE MONTHLY would enjoy, fiction bearing some relation to science as it is practiced on Earth.

Creative literature is, after all, only an imitation of life. Its reason for existence is to mirror man's accomplishments, hopes and fears. But the mirror of science-fiction today is rapidly losing its quicksilver. From its barren glass the sterile emptiness of space stares so darkly that even the editors of SF magazines are repelled. H. L. Gold, of *Galaxy*, wrote a double-header editorial in his February and March 1954 issues to this effect:

"Look, fellows! It may not be necessary to go out to the stars just yet to find living space for our excess populations. There's a lot of room left right down here on the Amazon river."



Terrestrial and celestial detectives make a rather weird team

The Moon-Mars-and-Venus rocket jockeys will argue, of course, that people ought to know about space because Albert Einstein proposed space stations to defend democracy in the atom age. They have a point. But shouldn't people

.....You Got a Point of Order?.....

John Lear's acid remarks on today's science-fiction writing will, the editors of PSM suspect, cause some astral addicts to reach for their ray guns, crying, "Blast off!" Others may wish to present him with an impervium-plated medal. For the five most interesting letters, of 150 words or less, commenting on this article, and received by Sept. 1, PSM will pay $25 each. Address: The Editor, POPULAR SCIENCE MONTHLY, ***353 Fourth Ave., New York 10, N. Y.***

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also know, and know *first*, about the strategic power vacuum of the Canadian Arctic? We can't do much with the North Star if we lose the North Pole.

This is not to imply endorsement of SF writers playing cops and cowboys if they play Royal Canadian Mounties and reindeer herders instead of chasing rustlers through the gulches of the Milky Way. I think SF should abandon completely the worn-out Wild West and private-eye themes. To put it bluntly: let's have some *science* in science-fiction!

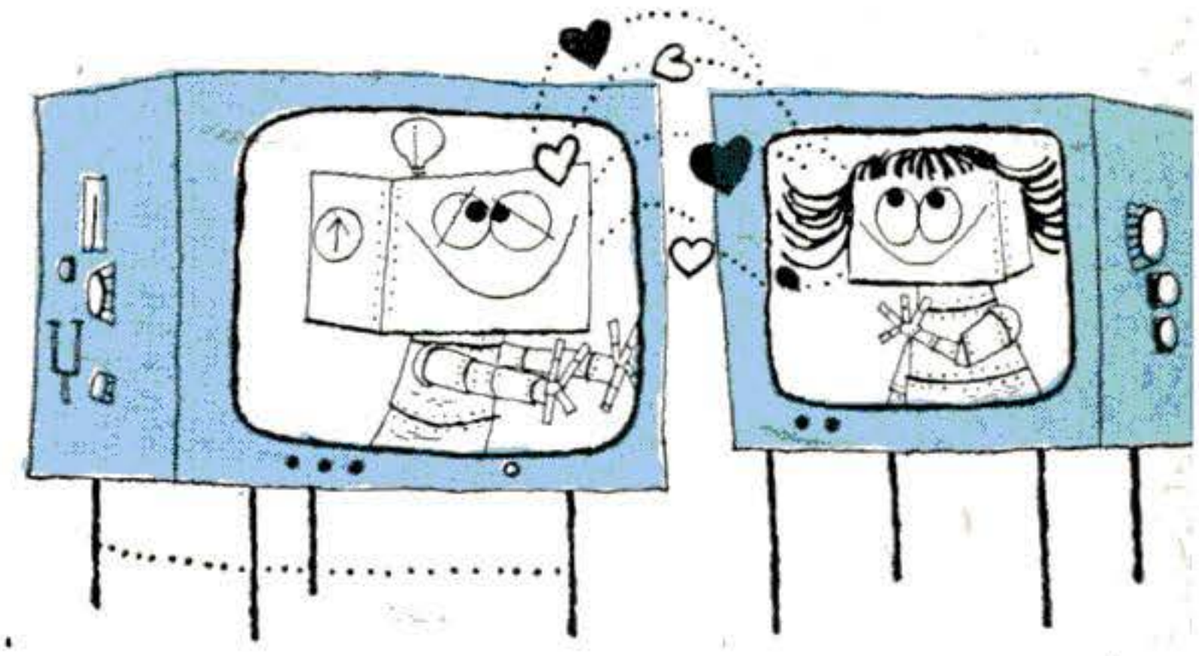
By calling themselves writers, the signers of SF stories forfeit any right to be excused from the sweaty digging for facts and the still sweatier travail of disciplined imagining that might enable them to depict (as Jules Verne did with his submarines and flying machines) wonders that will sound plausible to us and commonplace to our children.

No Brain Waves for Ralph

It is fashionable for current SF practitioners to sneer at Hugo Gernsback's old SF classic—*Ralph 124C41+*—as "unreadable." But to me, Ralph is considerably less of a cardboard character than most of the tipsy space sailors I meet in SF today. At least Ralph's romance, though steeped in intellect, was mature. He didn't try any of the now-popular adolescent tricks like remote-controlled seduction through aphrodisiac brain waves.

Gernsback was wordy. He was Victorian. His story, however, moved logically. And his science, though wondrous, rang with possibility. It is not enough to remember him as father of modern SF. His sensitivity to significant trends calls for critical study in the light of science's implacable encroachment on all human affairs.

Ralph first appeared in print in 1911. Yet through him Gernsback fancied the coming of TV, radar, simultaneous multilanguage translation, man-made rain, transatlantic airplanes, helicopters, cold light, night ball games, automatic packaging, the use of sound as a physical



Why not remote-controlled romance?

force, titanium, microfilm, rayon, artificially accelerated plant growth, glass brick, guaranteed bank deposits, directed research in science, and government domination of certain areas of research under a blanket of secrecy.

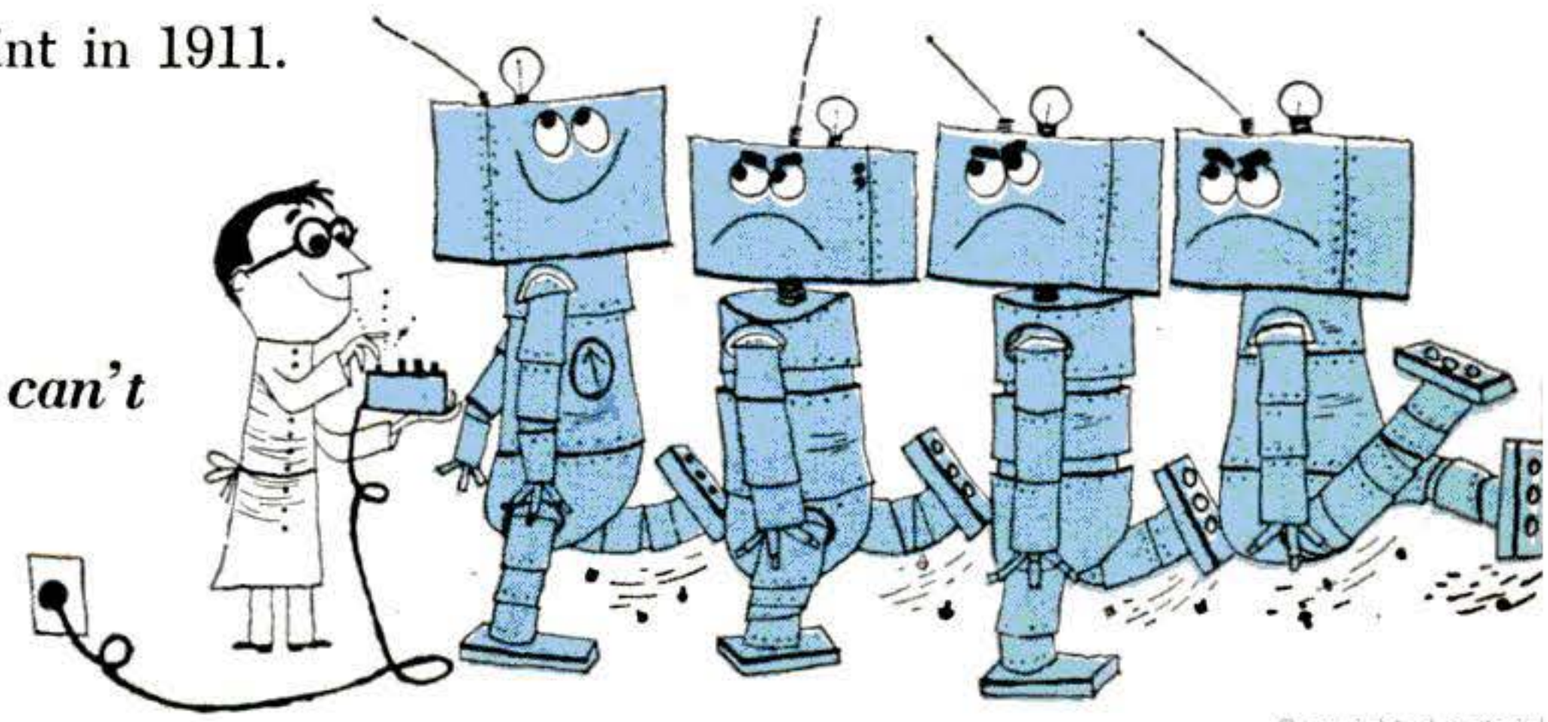
Incredible prophet that he was, Gernsback had no monopoly on the art. In the last decade, Robert Heinlein duplicated Ralph's panoramic vision in narrower compass with more immediate and spectacular results. Heinlein predicted not only the A-bomb but its use to annihilate a city to end a war.

But where are Gernsback's and Heinlein's disciples? Why is their method so rarely followed in science-fiction?

The mailman brings me seeds for scientific speculation every day.

An atomic locomotive is now feasible. Railroads have been the subject of adventure stories for years. Trains will be vastly different when engines re-

[*Continued on page 244*]



It's worth remembering that robots can't outthink their makers

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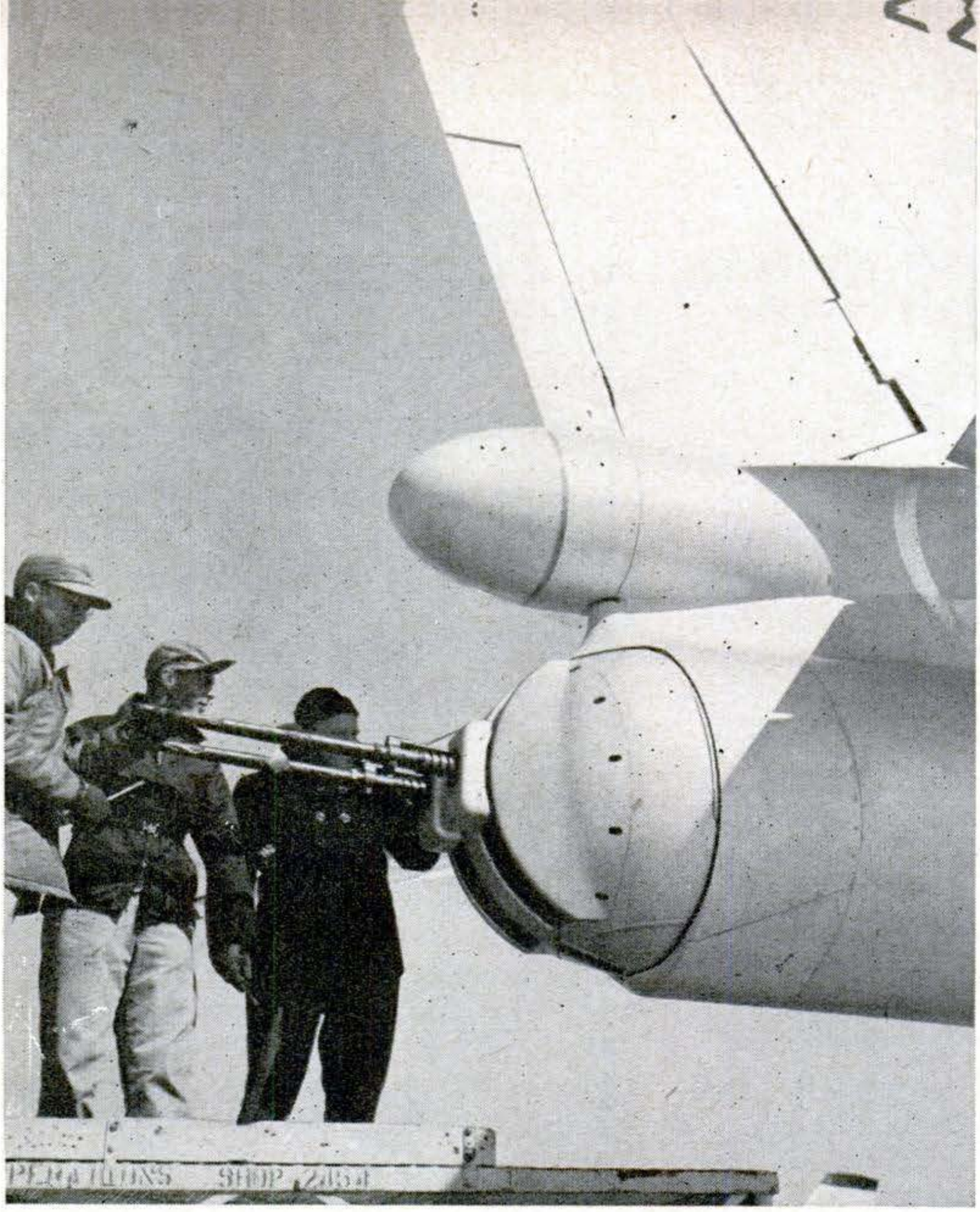
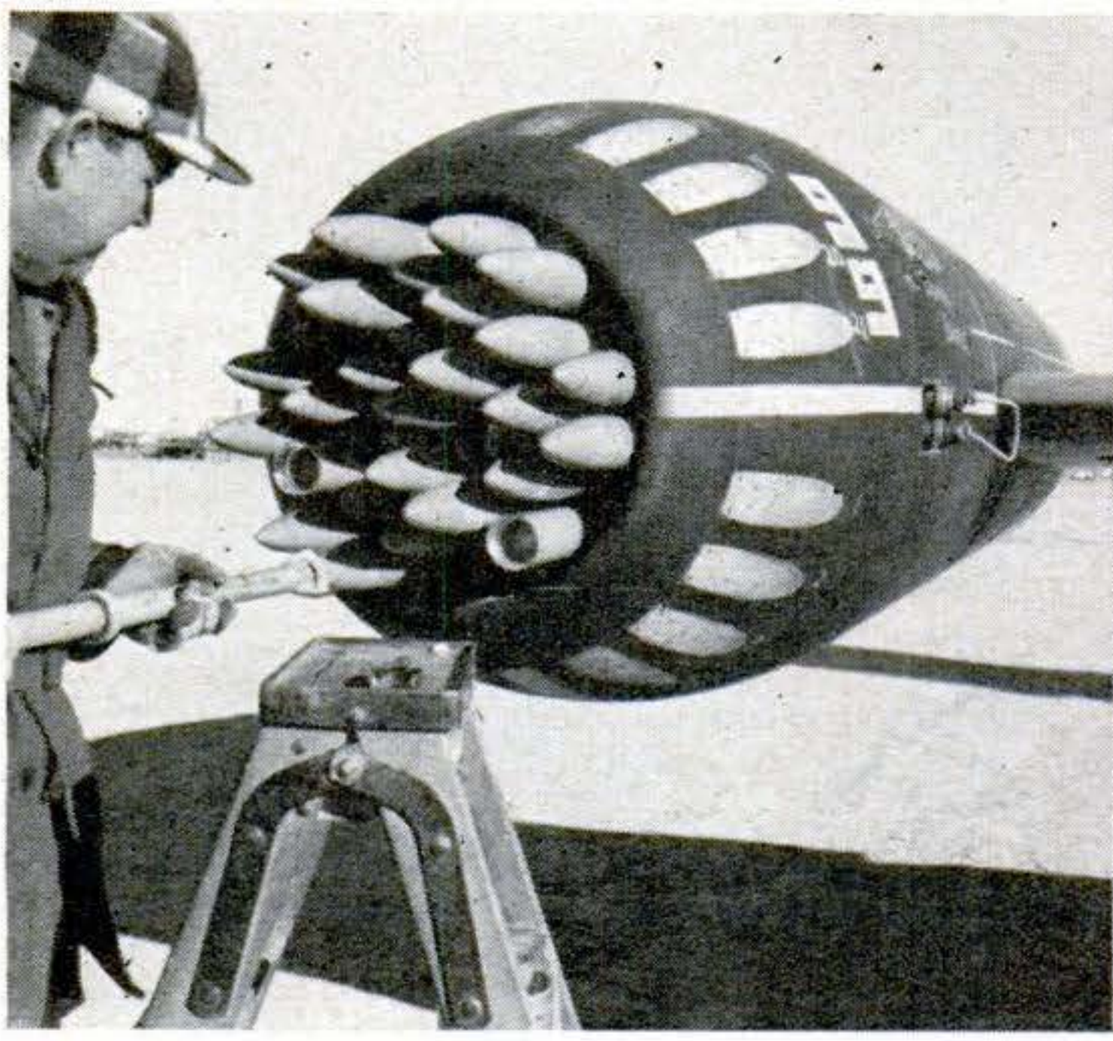


Radar in Tail Aims Bomber's Robot Guns

TAIL guns that are fired at targets automatically tracked by radar are now part of the armament of the Air Force's Boeing B-47E Stratojet bomber. The entire tail-turret system is remotely controlled.

This is how it works: In danger areas the radar is switched to "search." When it picks up an attacking plane, it begins supplying a computer with information for the 20-mm. guns. When the target is within range, the guns are fired. Two guns are mounted in the full-swiveling turret.



Deadly Egg Spews Out Rockets

A HONEYCOMB of 52 rockets is carried on each wing of the Air Force's Northrop Scorpion fighter. The honeycombs, which look oddly like the egg-shaped nacelle housing an airplane's air-cooled engines, can be fired in salvo. A hit by even one of the 2.75-inch rockets can down a bomber. The Scorpion can climb higher than nine miles.

Airplane Is Moved Like a House

IT WAS exactly like moving a house through the streets of Los Angeles when a Douglas attack plane with its wings on had to be trucked from the factory to Edwards Air Force Base, 171 miles away. Telephone poles, traffic signals and roadside trees had to be removed and replaced afterward. The speed? Five miles an hour.

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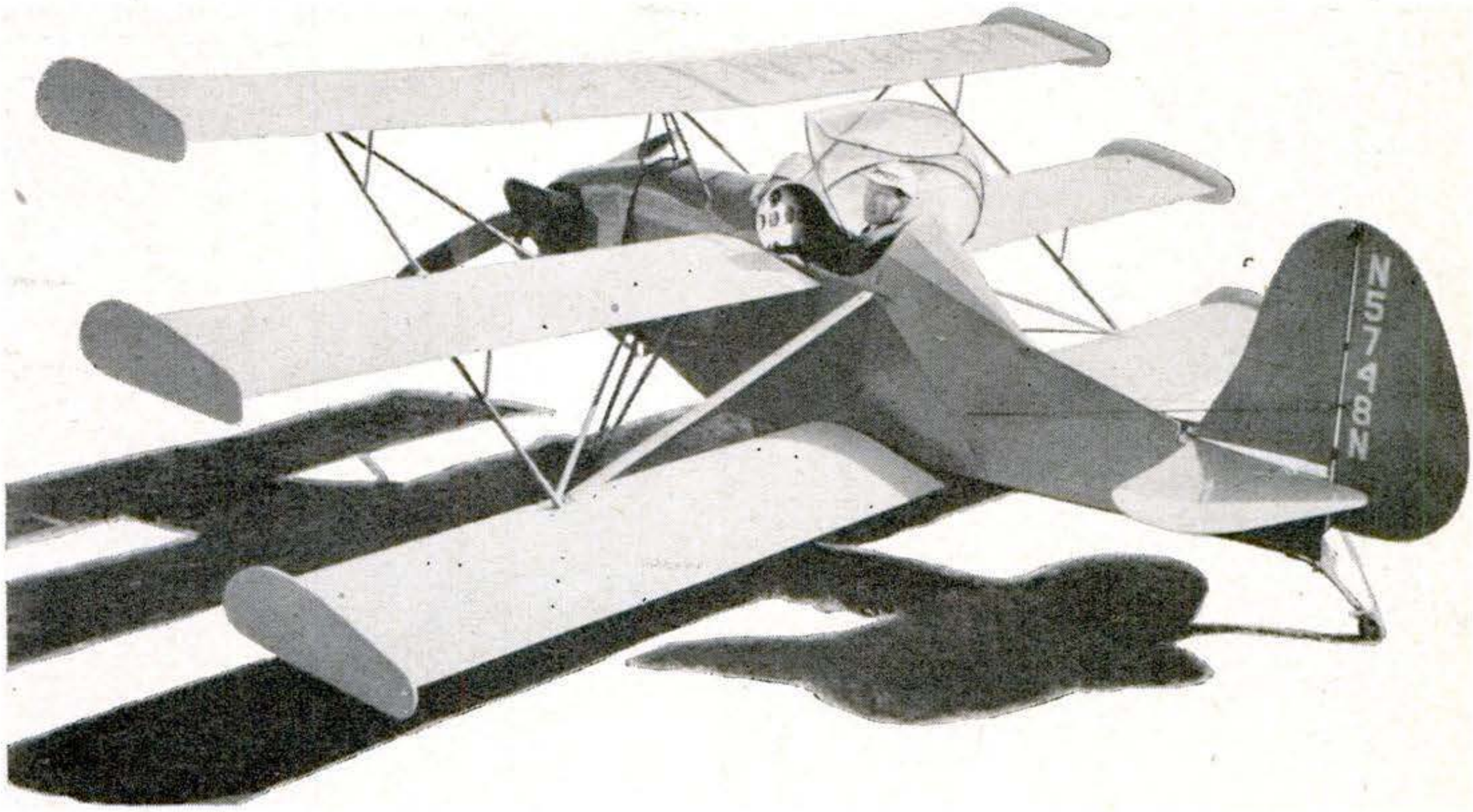
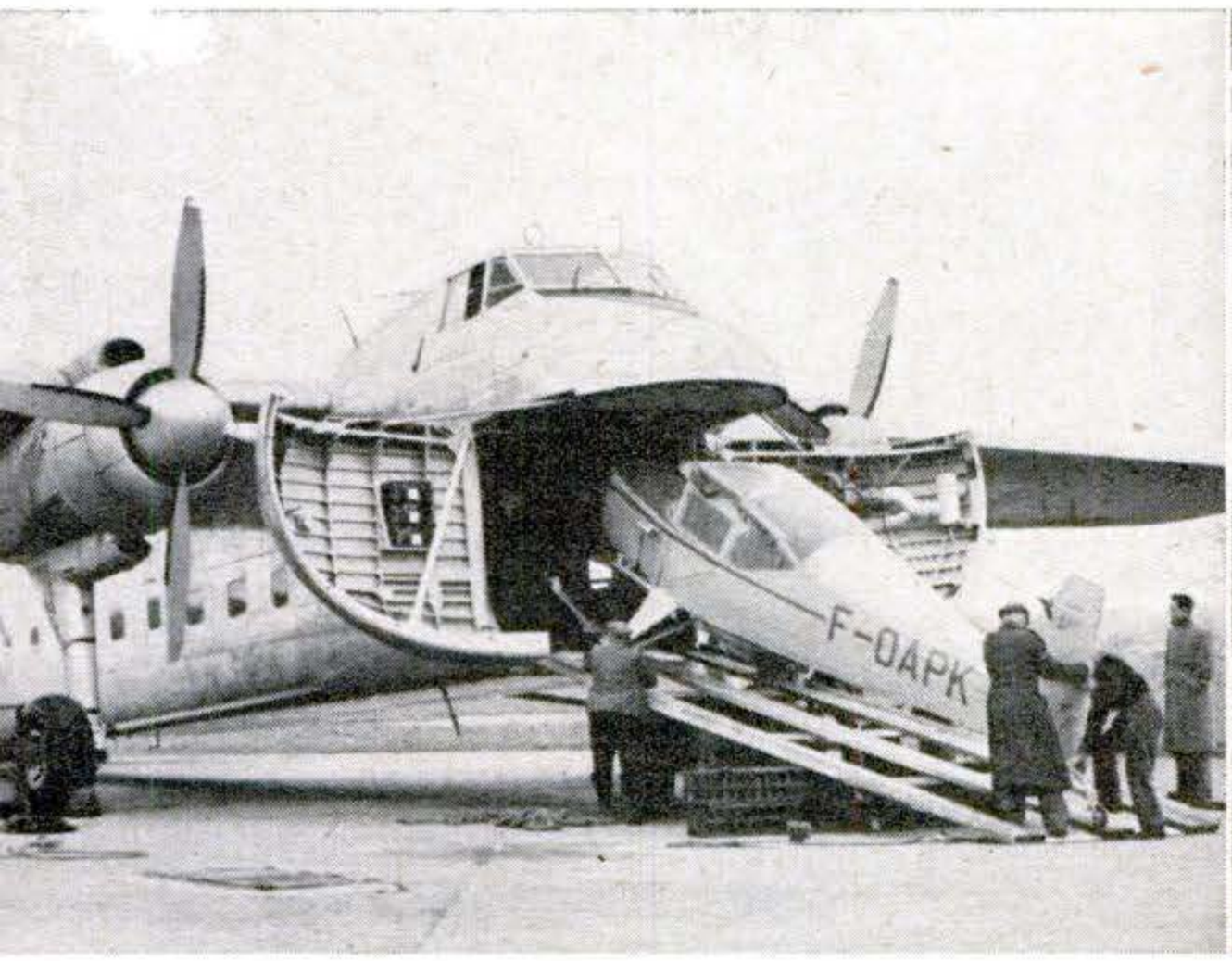
Three-Winged "Flea" Flies 100 Miles an Hour



A TRIPLANE that its builder, George Frisbie of De Pere, Wis., calls "The Flea" has only a 20-foot wing span and flies at a speed of about 100 miles an hour. The little plane measures 15 feet in length.

Frisbie has test-flown it under the supervision of the Civil Aeronautics Administration, but there are still other tests to be made. He is also the inventor of a plane he hopes to sell in kit form.



Freighter Swallows Midget

A BRISTOL FREIGHTER plane gulped down a midget plane recently through its huge front loading doors—and then proceeded to swallow a second one. The first was loaded headfirst, the second tailfirst.

The two smaller aircraft were destined for French Indochina. Bristols are used regularly as English Channel car ferries.

Radar Helps Pilot Shun Storms

THE days of those bouncy airliner flights in rough air will be over if a storm-detecting radar system being tried out by Panagra is adopted generally. It will "see" storms 150 miles away.

The company is testing the radar between Miami and Buenos Aires. It is installed in a DC-6B transport.

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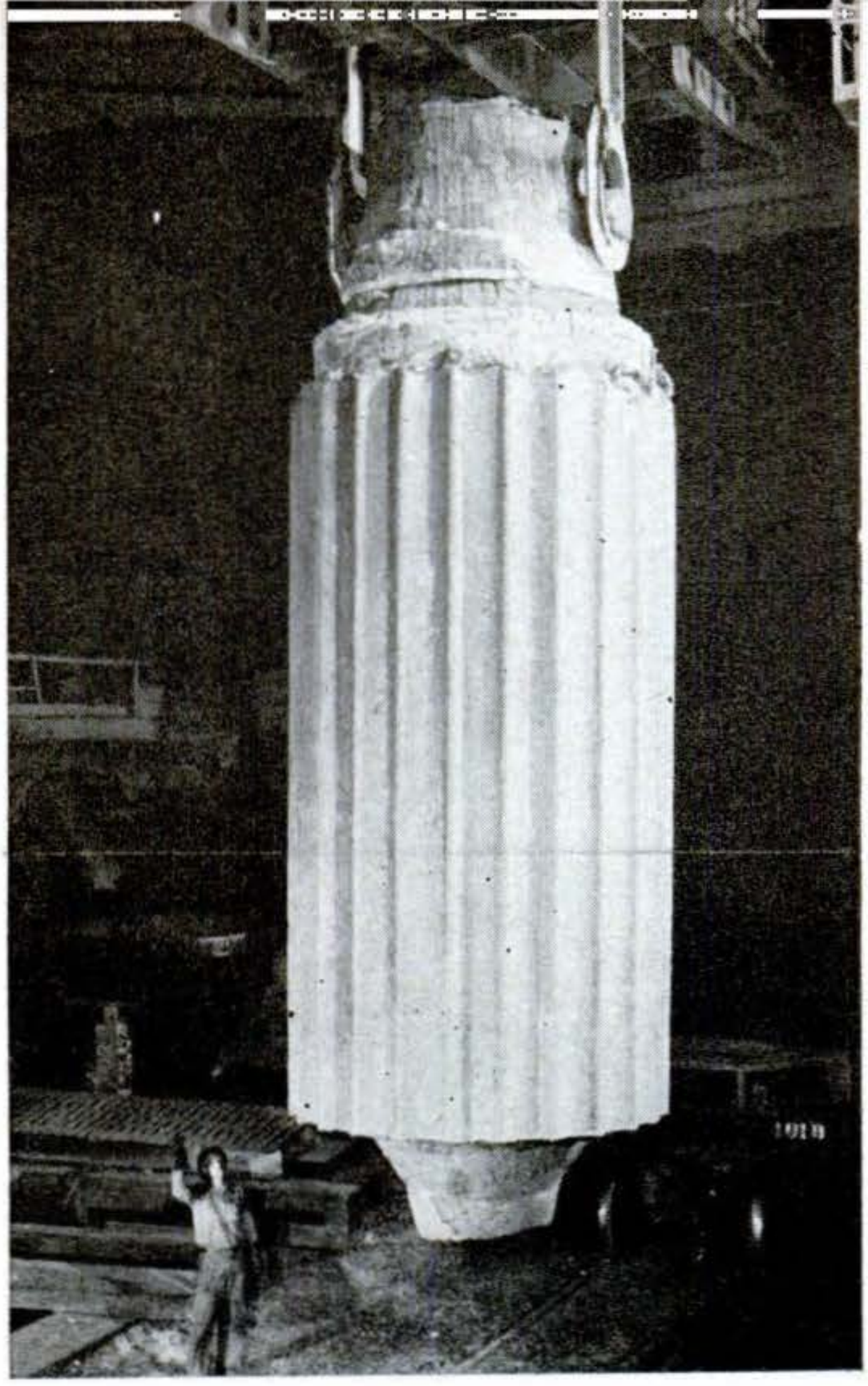
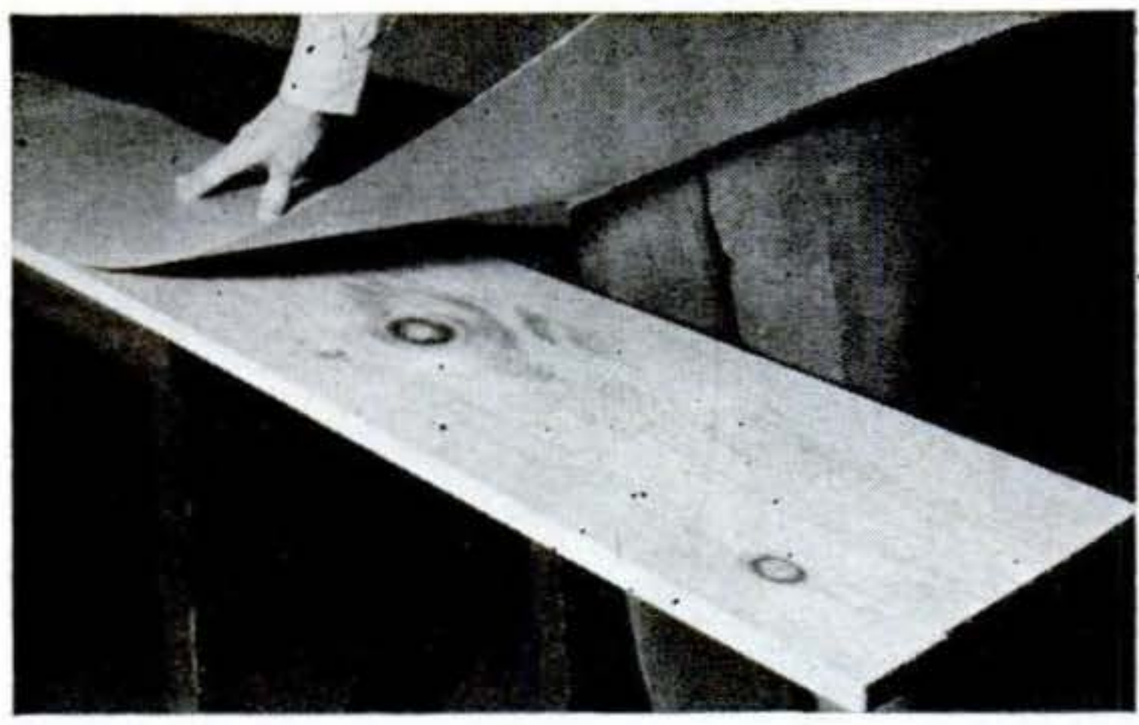


275 Tons of Steel—in One Hunk

THIS huge ingot, weighing as much as 160 Ford sedans, is on its way to a Bethlehem Steel forge to be pounded into a 110-foot column—one of 18 supports for a tremendous airplane press 10 stories high.

Man-Made Geyser Tests Nozzles

WATER, pumped from the Allegheny River, geysered 150 feet in the air (above) when engineers tested nozzles for fountains that will spout from a pool in Point State Park, Pittsburgh.



Paper Overlay Upgrades Lumber

SCIENTISTS at the U.S. Forest Products Laboratory at Madison, Wis., have discovered that a single sheet of paper, treated with modern synthetic resins, will hide knots, pitch pockets, stains and narrow splits in a board (above). They have also found, by installing paper-overlaid pine siding on a test building (right), that it holds paint well outdoors and slows wood-swelling.

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Bailing furiously with their helmets, damage-control crewmen improvise when pumps balk.

How Sailors Learn to Save a Ship

Daily they rescue a bogus cruiser "bombed" in a bogus ocean.

"THE bomb that hit the USS *Buttercup* was delivered by a lone plane at 1700 hours, just before evening chow. Shattering plates and rupturing mains, the resulting explosion might have been fatal to the cruiser had it not been for the skilled work of her damage-control parties."

This could have been a news dispatch from an artificial ship in an artificial ocean at the Philadelphia Naval Base Damage Control School. Daily it weathers a tape-recorded air attack, is ostensibly hit, ships water through real holes and threatens to sink, in order to teach U.S. sailors what to do if the danger ever becomes real.

The vessel, a two-deck section of a cruiser, floats in a tank. Its survival depends on the quick thinking and trained action of men who work in water up to their necks, bail where pumps would normally not function, fight smoke and fire, plug and patch. How they do it is shown in the photographs on the next two pages.

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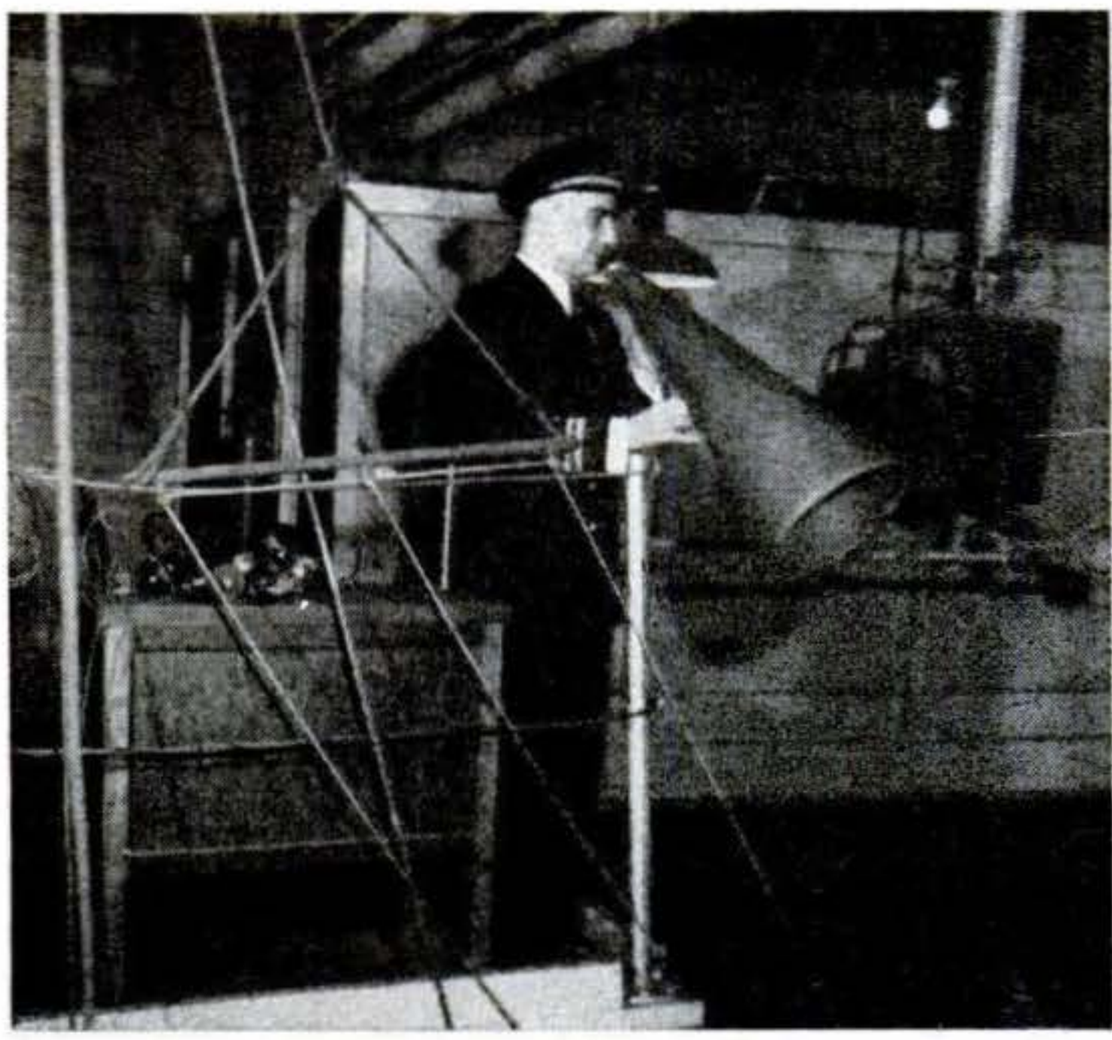
SAILORS SAVE A SHIP CONTINUED

1 LIKE THE DUTCH BOY at the dike, a sailor stops a leak with one hand in damage-control drill as his mates rush repair work.

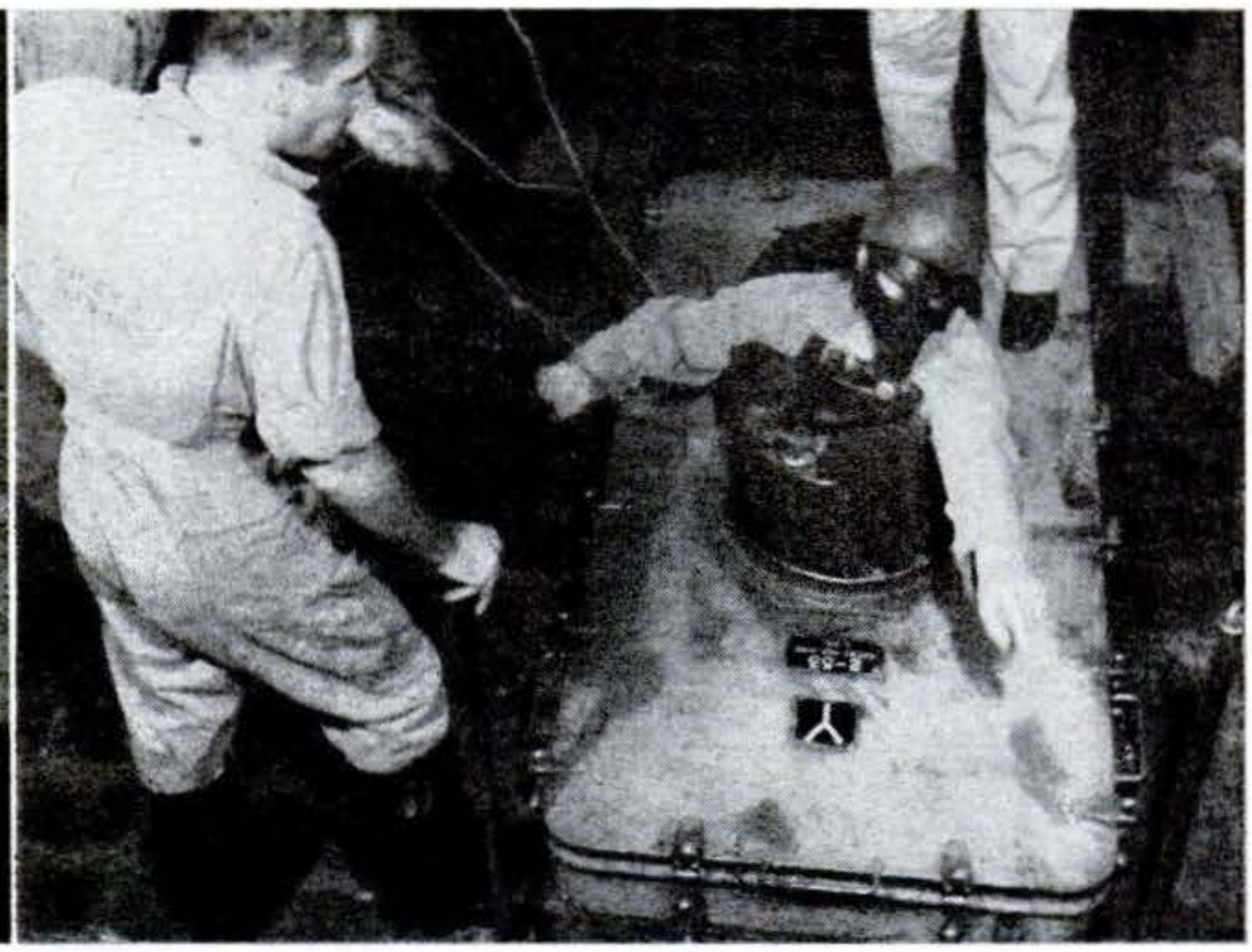
2 SHORING UP damaged bulkheads is an urgent task after the pumps, under mesh protectors at the men's feet, are back at work.

3 DOUSING A BLAZE that threatens further damage to the injured "ship," damage-control trainees use helmets as buckets.

4 EVACUATING THE "WOUNDED" to safer areas must go on while part of the rescue crew struggles to plug gaps in the hull.



6 ORDERS FROM THE BRIDGE of the ever-sailing, ever-sinking cruiser are megaphoned to the men toiling in water below decks.



7 REPORT FROM BELOW on the location of fire comes from a crewman in an oxygen mask, protected from smoke poisoning.

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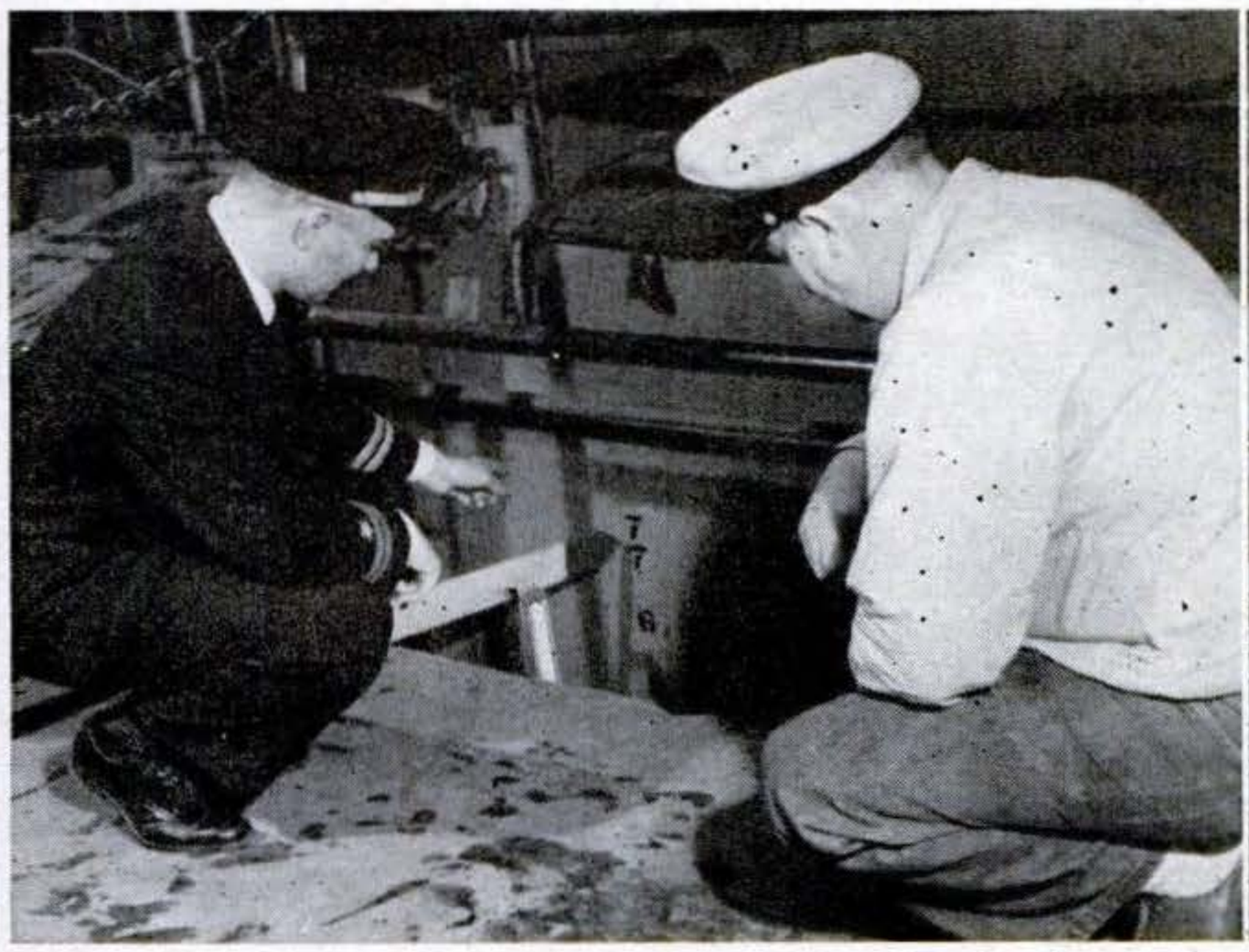
5 **A NOTICEABLE LIST** to the deck of the *Buttercup* develops as the damage-control party feeds pump hoses to flooded compartments. The training vessel consists of a two-deck section of a U.S. cruiser. It is 48 feet long and its ocean is a large indoor tank.



8 **ALL IS CONSIDERED LOST** if, despite the rescue party's grueling efforts, this pointer indicates a list of seven degrees.

9 **EXHAUSTED RESCUERS** grimly catch their breath and rest while the inexhaustible *Buttercup* regains an even keel. END

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Gus Rides Out a Storm

By Martin Bunn

Two scared kids in a jam take the Model Garageman out into one storm to quell another—between irate parents!

AS DARKNESS came down, clouds piled up in the west and a sharp thunderstorm took the edge off the midsummer heat. Glad at the chance to catch up, Gus Wilson was working late at a top overhaul. The Model Garage lights were the only ones on in the dark business section of town.

The clatter of running footsteps outside the open shop door brought Gus from under the hood. Matt Bergstrom and Mrs. Adams, both winded, passed the pumps and made for him.

"Gus!" Matt puffed. "Haven't you got a boat up at the lake? May be trouble there—kids got caught out in the storm—should've been back hours ago. I thought they were at the Adamses and she thought—"

"Tell me on the way," Gus cut in. He bustled them into his car, strode over to pull the main switch of the garage, and took out fast.

Panic Sets In

By the time they neared the lake, Gus had the story. Bergstrom's taffy-haired daughter Sally had gone for a swim and picnic with 16-year-old Guy Adams. They'd taken the Bergstrom outboard, heading for the beach on the far side of Thatcher's Island. When Sally didn't show up for supper, Matt assumed they'd waited out the thunderstorm at Lora Adams' home. When, at nine, Lora had called him, a kind of panic had begun to lick at both parents.

"Neither youngster is a strong swimmer," said Lora. "I just hope that storm didn't catch them out in—"

"Probably waited for the storm to blow over," Gus said quickly, "and then discovered the rain had drow—soaked the ignition." It occurred to him that Matt and Lora had infected each other with a highly contagious anxiety. "We'll be there in a couple of minutes now. If the lake's not too rough, we might take a run out to the island. Probably find them soaked and sheepish. Will you dig my flashlight out of the glove compartment, Matt?"

The Party Sets Out

Fair-sized waves were tossing Gus's 12-footer at its pole mooring, and rain water sloshed the floorboards. "Doesn't look so bad," Gus told them briskly. "Lora, you get in the bow and hang onto the flashlight. Matt, will you do some bailing from the middle seat?" He stripped off the cover, checked the gas and spun the kicker.

The wind was behind them as they headed out onto the lake. A past-full moon showed occasionally through scudding clouds, dimly picking out the ridge behind Thatcher's Island.

"Don't stand a prayer of finding anything in all this blackness," said Matt grimly. "I think we ought to go back to a telephone. Call the state police and

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Gus uncoupled both ends of the gas line and drew out a two-inch bronze filter element.

get them to start a real search going."

The same idea had been in Gus's mind for minutes. "Maybe you're right," he conceded. "But let's take a fast look at the beach first—we're almost there."

As they rounded the point of the island, the hearts of all three in the boat gave a flip-flop—there was a campfire in the cove. The distant reddish light glinted off the aluminum hull of the beached Bergstrom boat, and two small figures danced like Indians in the fire-

Copyrighted material

light. Both Matt and Lora were calling as the boat slowed to coast in.

During the first moments of greeting, Gus busied himself with tilting the engine and pulling the hull up on the beach. Then he sauntered up to the group by the fire.

Storm Over the Lake

" . . . The silliest thing," Sally was saying. "Robinson Crusoe all over again—my name's Friday. I guess we were a little late in starting home. Anyhow, the clouds were awfully black, and we were just coming out of the cove when it began to rain like *anything* and I made Guy go back because I just *knew* we'd get struck by lightning. He said we could take off the motor and turn the boat over for shelter—it was just *drenching* — but I knew that that metal boat would attract lightning and—"

"We're making marvelous time . . . just listen to this old buggy purr!"

"So we just waited out the storm in the woods," Guy finished. "I tried to tell Sal that trees were no protection against lightning, but you know how it is with women."

Guy's good spirits evidently grated on Bergstrom. "That's all very well, young man. But the storm blew over hours ago. Why didn't you come home right afterward? Your mother and I were both extremely worried."

"Daddy, we *tried* to three times, but the motor kept sputtering out," Sally interjected. "The wind was against us and we didn't have any oars and that old motor kept stopping. So Guy built a fire in the *cleverest* way and we just waited until—"

"That's enough," Matt cut in. "I'll talk to you later. Evidently you've never heard of smart alecks who manage to run out of gas when it suits them. Well, young man, what's your story?"

"Look," said Lora Adams, "must we stand around here while you put witnesses on the stand? These children are wearing wet clothes and I think it's important to get them home instead of letting you sound off."

"I'm not sounding off. But I don't propose to let my daughter go out with a kid who can't even tell a straight story."

"You mean he can't get a word in. If you'd stop bullying him long enough—"

"Bullying—that's a laugh! The important thing is why a young girl was kept out for hours when there isn't a shred of justif—"

"Motor kept conking out, Guy?" Gus tossed a piece of wood into the fire. "Sounds like the rain got to it." He realized that the flare-up, even though it was just a reaction to anxiety, ought to be headed off if possible.

"Well, I thought so too, Mr. Wilson, but it doesn't make any sense. Because each time it'd start right up and run fine at low speed with the prop in neutral. And then she'd quit as soon as we'd start out for home."

"That's very plausible, young man—especially the part about not making any sense. That motor runs like a clock—hasn't missed a beat all season. What were you really doing—shutting off the gas line?" Matt's voice was icy.

"No, sir. I was not."

"Or did you just close the air valve on the cap so the gas wouldn't feed down?"

The Feud Begins

"I've had just about enough of this," said Mrs. Adams shrilly. "More than enough. I'm not going to stand around all night listening to somebody who's crazy as a hoot owl. Gus, will you take me home? You come with us, son—you've seen enough of the Bergstroms."

[*Continued on page 224*]

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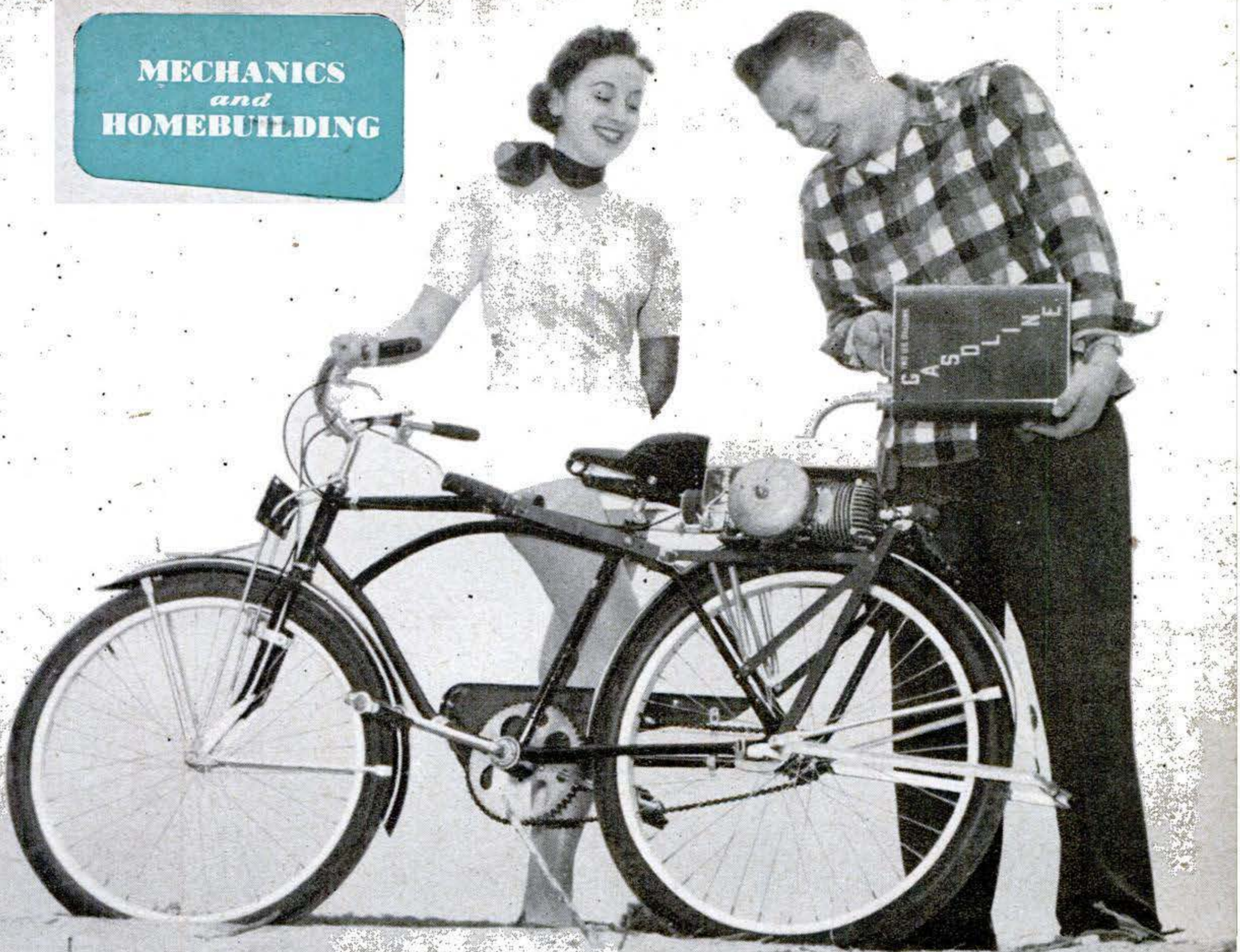

How to Hitch an Engine to Your Bike

A two-cycle power plant that you can attach with hand tools will whiz you along at 25 m.p.h. and run for only a few cents a day.

By Howard G. McEntee

EVEN the peppiest pedal pusher sometimes wishes he could keep rolling just by twisting a throttle. But the gap between an ordinary bike and a powered one ordinarily can't be plugged for much less than a hundred bucks—except with this homebuilt rig.

That doesn't mean jerry-built. This power unit is mechanically clean, functional, good-looking. You don't have to be a machinist to make it; the whole job can be done with hand tools.

What does it cost? The engine is the most expensive item. Mine is a 1.5 hp. Power Products AH-36, costing $47.50 brand-new. You can save by getting a factory rebuilt, with a new-engine guarantee, for about $36. With its horizontal cylinder, this engine is ideal for rear-wheel mounting.

If you are willing to settle for 1 hp., the

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RIDING TRIM. **Neat as a cotter pin, the rear-mounted engine drives the wheel through a friction roller, leaving pedal drive and coaster brake intact. No machining is necessary; all the work can be done with hand tools.**

model 1000 is available for about $25. It was widely used on power mowers, and you may find a secondhand one for even less. The other materials add up to about $13.

Roller drives the wheel. Only a friction drum or roller is mounted on the engine shaft; there are no pulleys or sprockets. Two coil springs pull the roller down against the top of the tire. This drive puts no torque strain on the spokes, and leaves the chain drive and coaster brake ready for normal use at any time.

The roller is disengaged from the tire by lifting the engine a fraction of an inch. This is done by a forked lever terminating in a handle below and in front of the seat. The clutch can be held out by a catch to let the engine idle at traffic stops.

Although the engine is on the left side, off center, no imbalance is noticed when riding. It may, however, tend to tip the bike if it is held up by a kick stand. A rear stand is more secure.

Put wheel in shape. The rear wheel bearings and coaster brake must be in good order. Check the wheel for wobble. If the rim is warped, it may have to be replaced. Otherwise, a wobble can usually be repaired by adjusting spokes, a job for an expert.

Mounting the engine. My engine came with a blower, an aluminum base and a small muffler. I removed all these, plus the governor mechanism with its cover. Thus stripped, the engine weighs about 13 lb.

The engine mount and clutch parts are made of common strap- and angle iron, pipe and ¼″ bolts. This is all simple hacksawing, filing and drilling. The rear fender has to be cut in two places. The rear bracket is clamped under the axle nuts, and the back fender section bolted to it. Two braces from the bracket are attached with clips to the rear fork.

The engine mount, consisting of two pieces of angle, pivots on the bracket and is connected to the clutch lever by slotted joints. Make certain the clutch lever is long enough so that its U-shaped yoke comes in front of the seat when it is up.

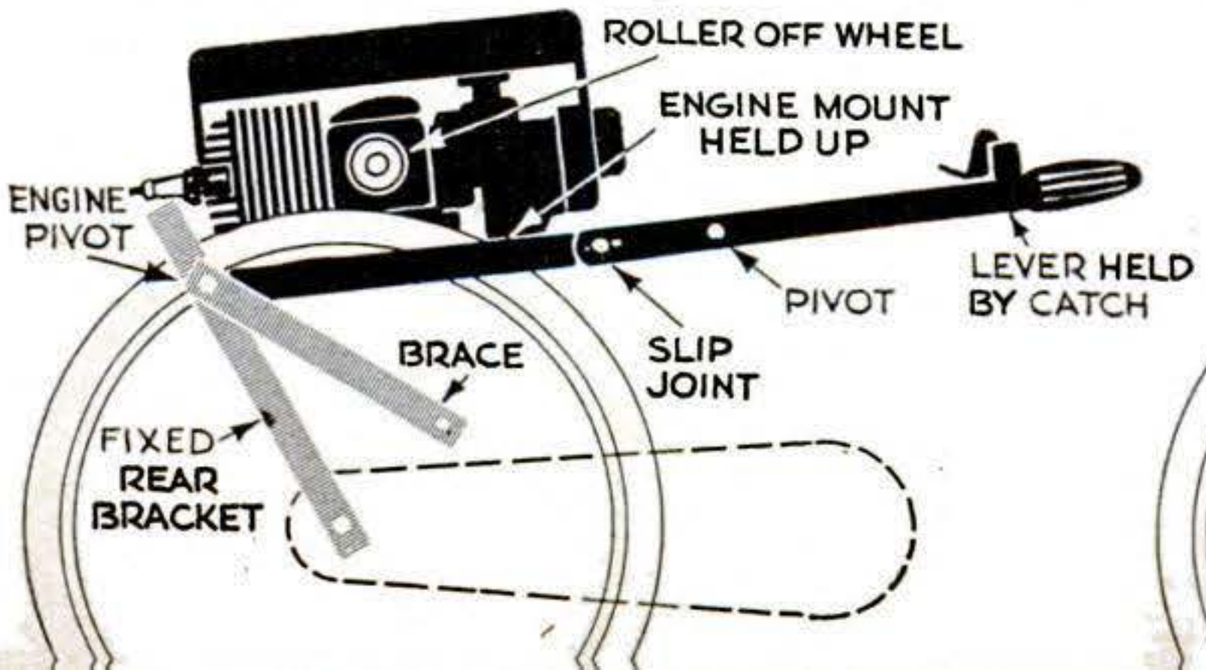
The clutch mount may have to go above or below the fork behind the seat post. Try it both ways before drilling for the clamp bolts, and space these to miss the frame members. On my bike, the mount fitted best with the angle up, so the tapped holes go through the apex of the angle stock.

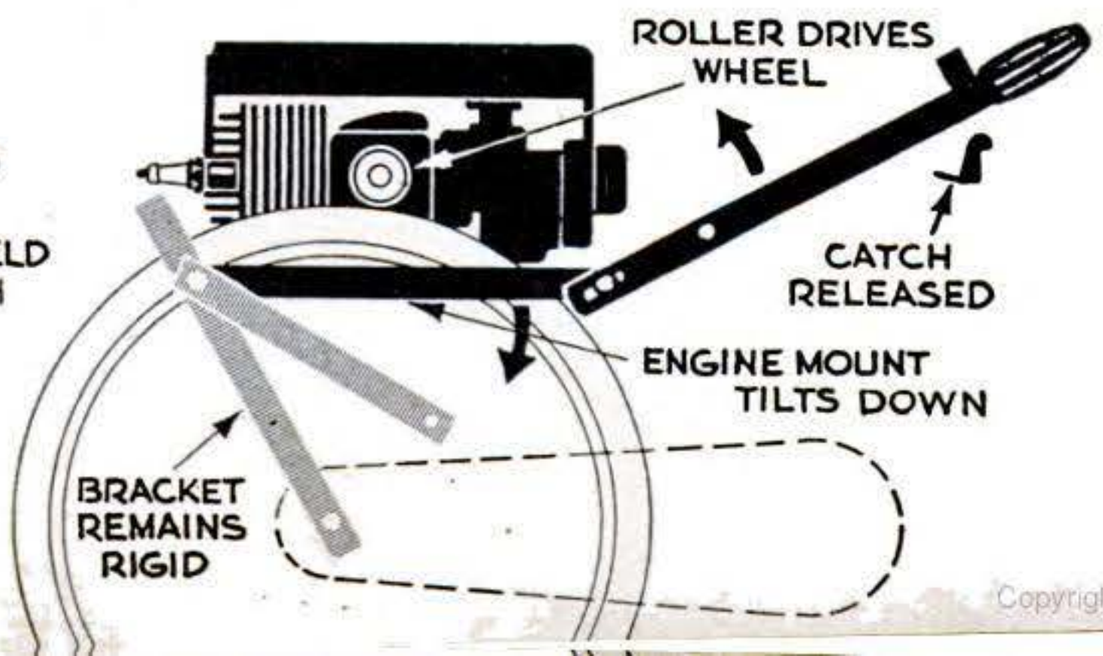
All bolts at the pivot joints must be positively locked, and drawn up to leave a minimum of play without binding. One member of each joint is therefore tapped. Drill No. 7 holes and thread them with a ¼″-20 tap.

A 3/16″ dural plate, 3½″ by 6″, is bolted to the left engine mount in two places and drilled to match the threaded mounting holes by which the engine was bolted to its base. You can clamp the plate to the dis-

How the Drive Works

All parts of the bicycle but the rear wheel and chain have been omitted in these diagrams for clarity. The engine mount pivots at the rear on a bracket rigidly bolted to the rear axle. A clutch lever pivots back of the seat post. It is connected to the engine mount by a slotted slip joint. When the clutch lever is held down, the roller is raised off the bike wheel. As the clutch lever is allowed to come up, the engine tilts down, and the roller is held in driving contact with the wheel by engine weight and two coil springs.





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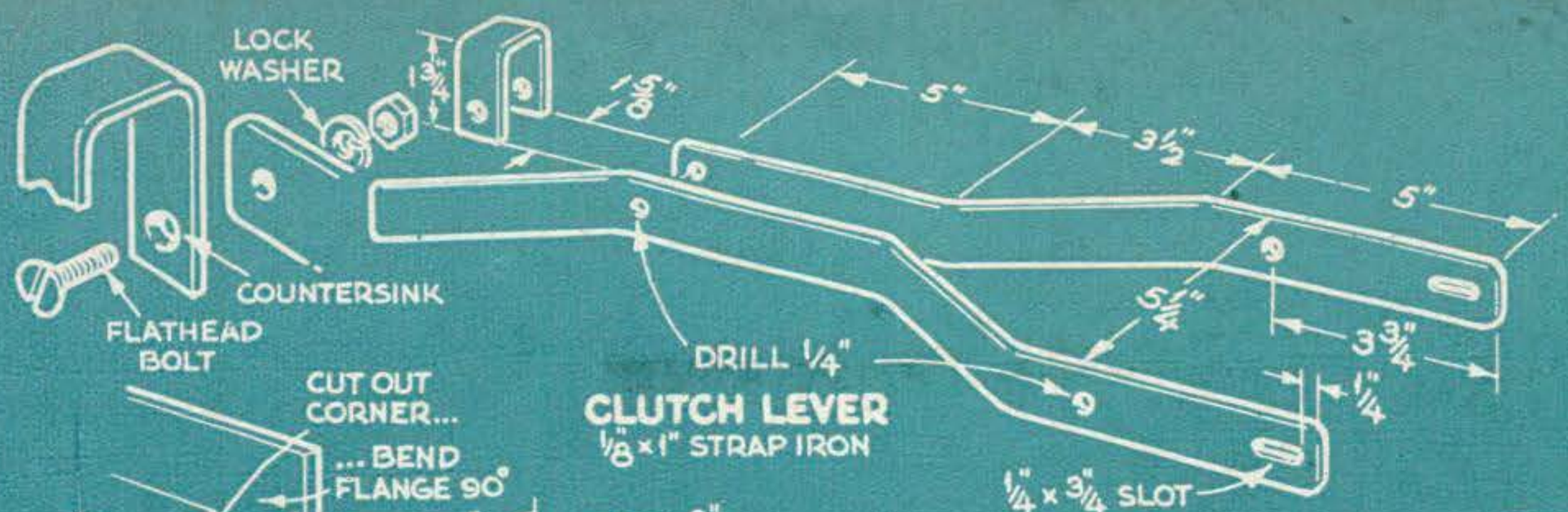
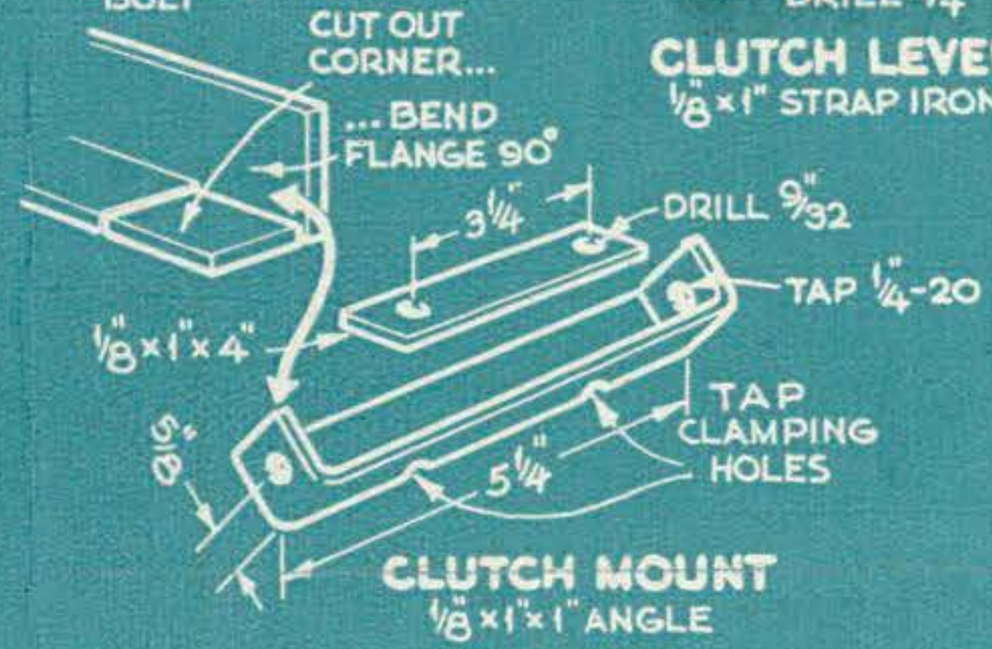
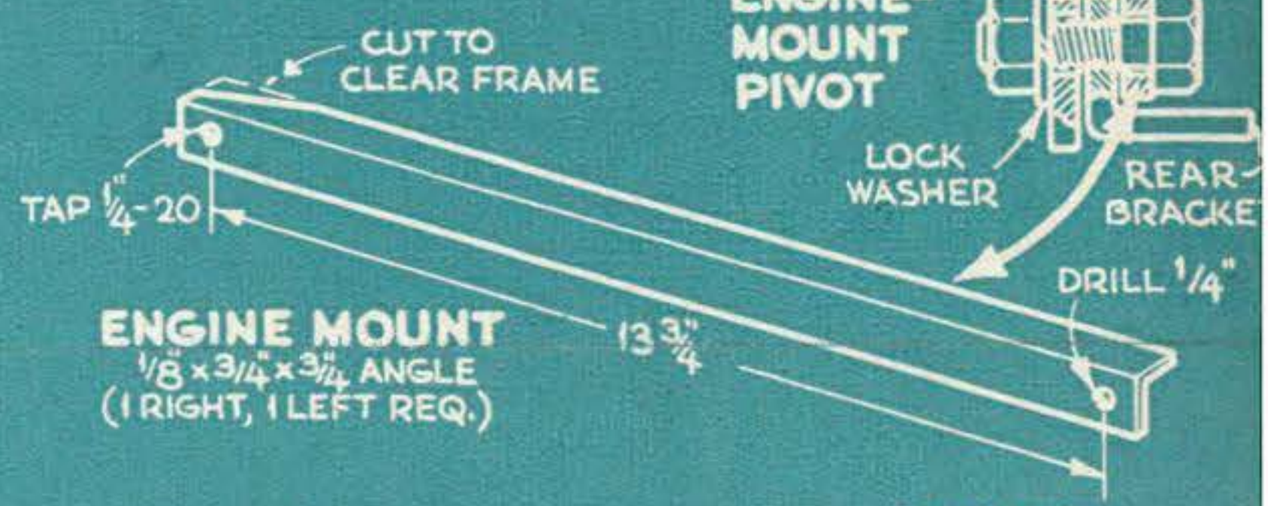
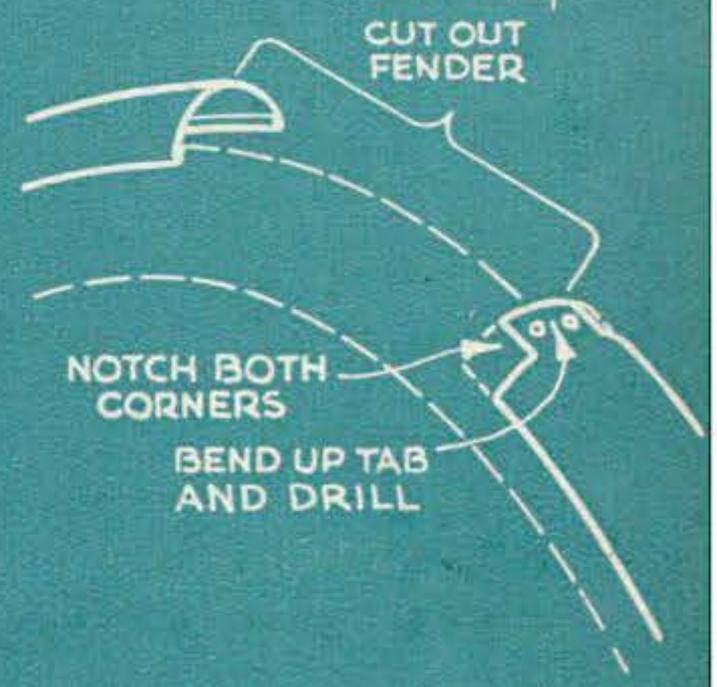
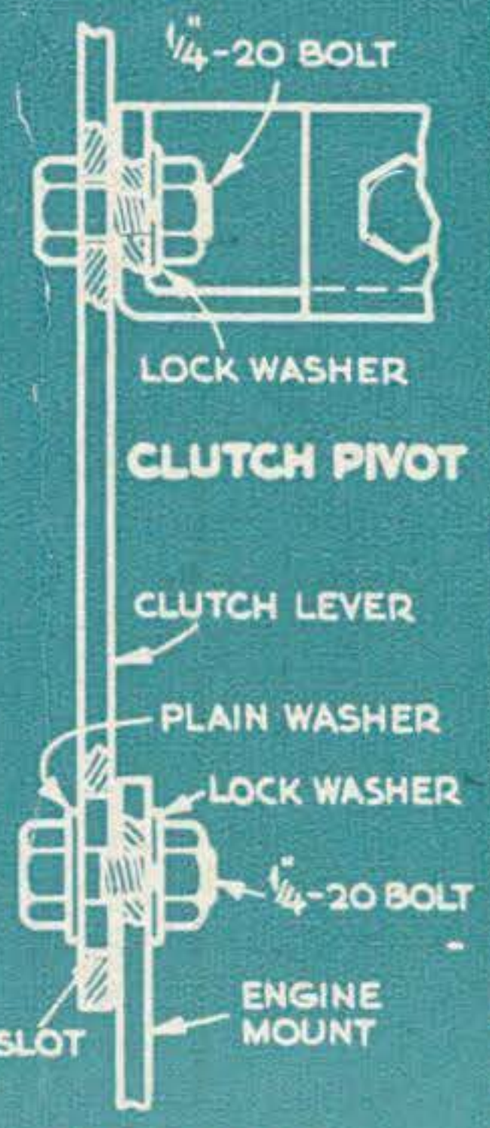
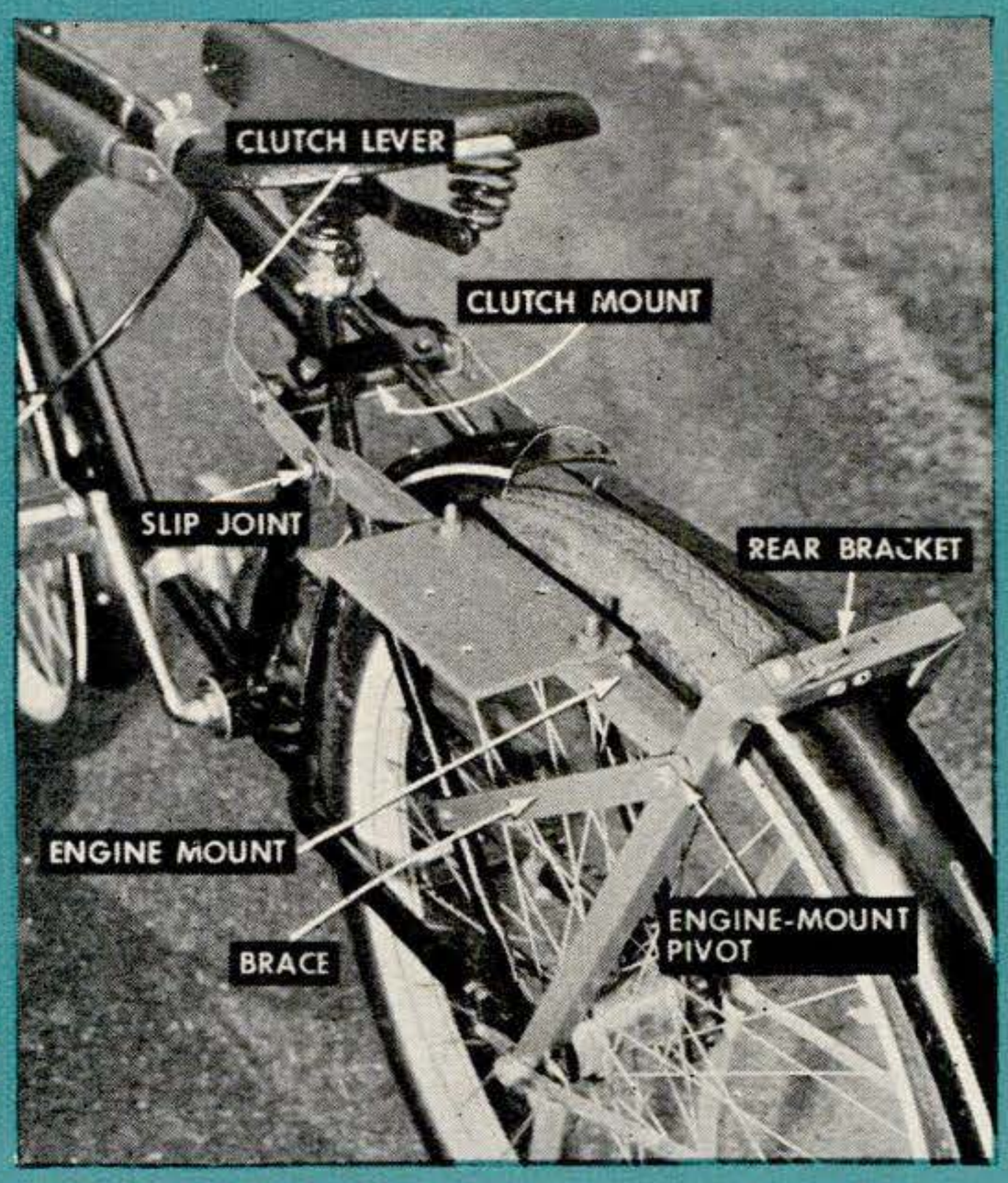




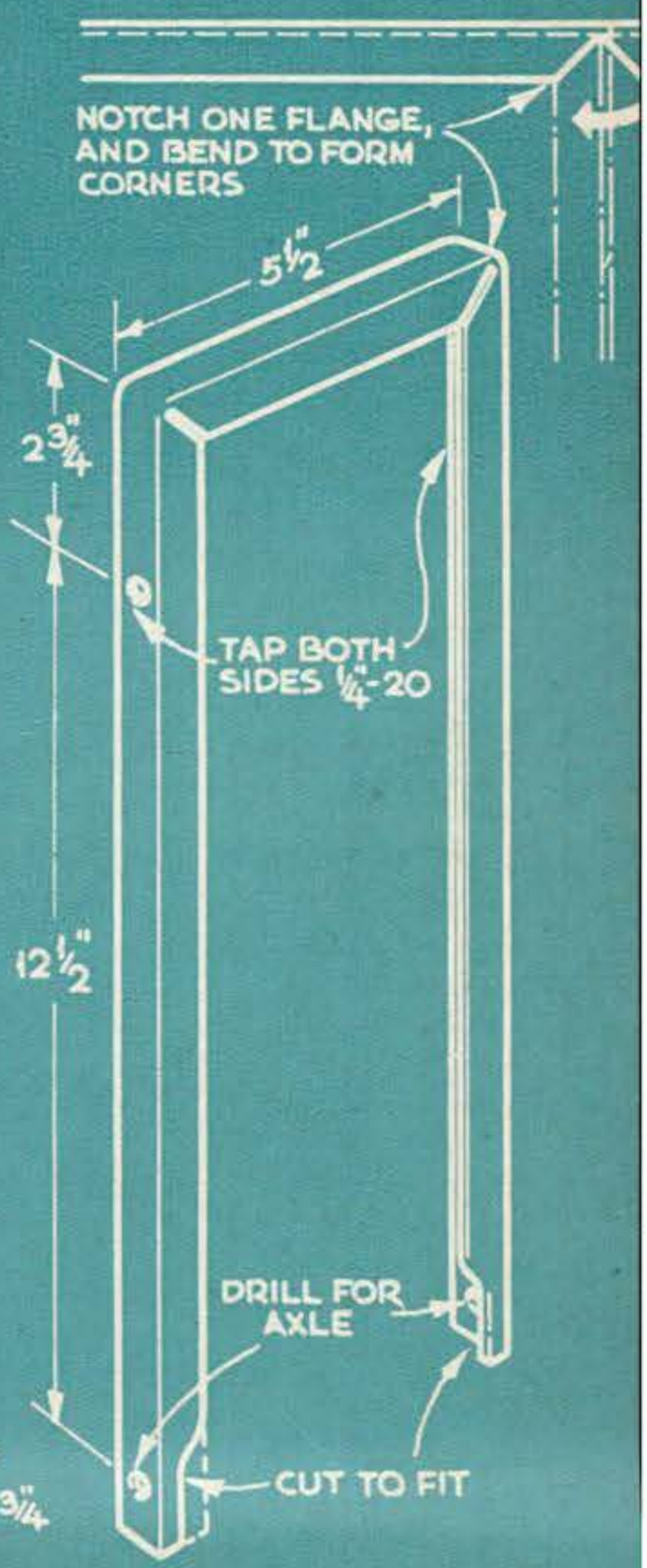


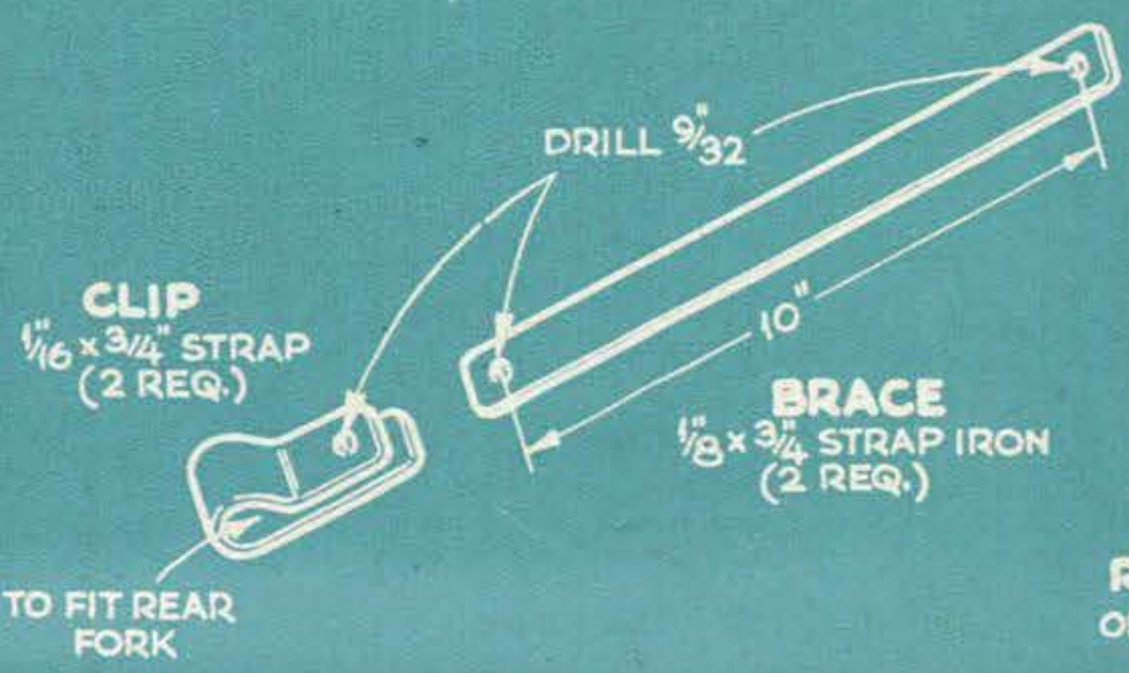






CUT, FILE, DRILL AND TAP strap and angle iron to make parts shown. Dimensions are for a 26" wheel, but check them against your own bicycle before cutting any stock. Screw each pivot bolt only far enough into its tapped hole to let the other member swing freely; then clamp the bolt with a lock washer and nut. Cut fender as shown, bend up cut end of rear section and bolt it to the rear bracket.





LIST OF MATERIALS

Engine: Power Products Model AH-36, type 1007 (Power Products Corp., Grafton, Wis.)

Roller: flat-belt pulley, compressed-paper face, metal hub, ⅝" hole, 1½" to 2" dia., 2½" long. (Frank Tracy, Inc., 202 Centre St., NYC.)

Controls: auto choke cable (throttle), bicycle brake lever and cable (compression release).

Exhaust: Briggs & Stratton muffler No. 89966, ½"-pipe floor flange, ½"-by-4½" pipe nipple, ½" 90° elbow.

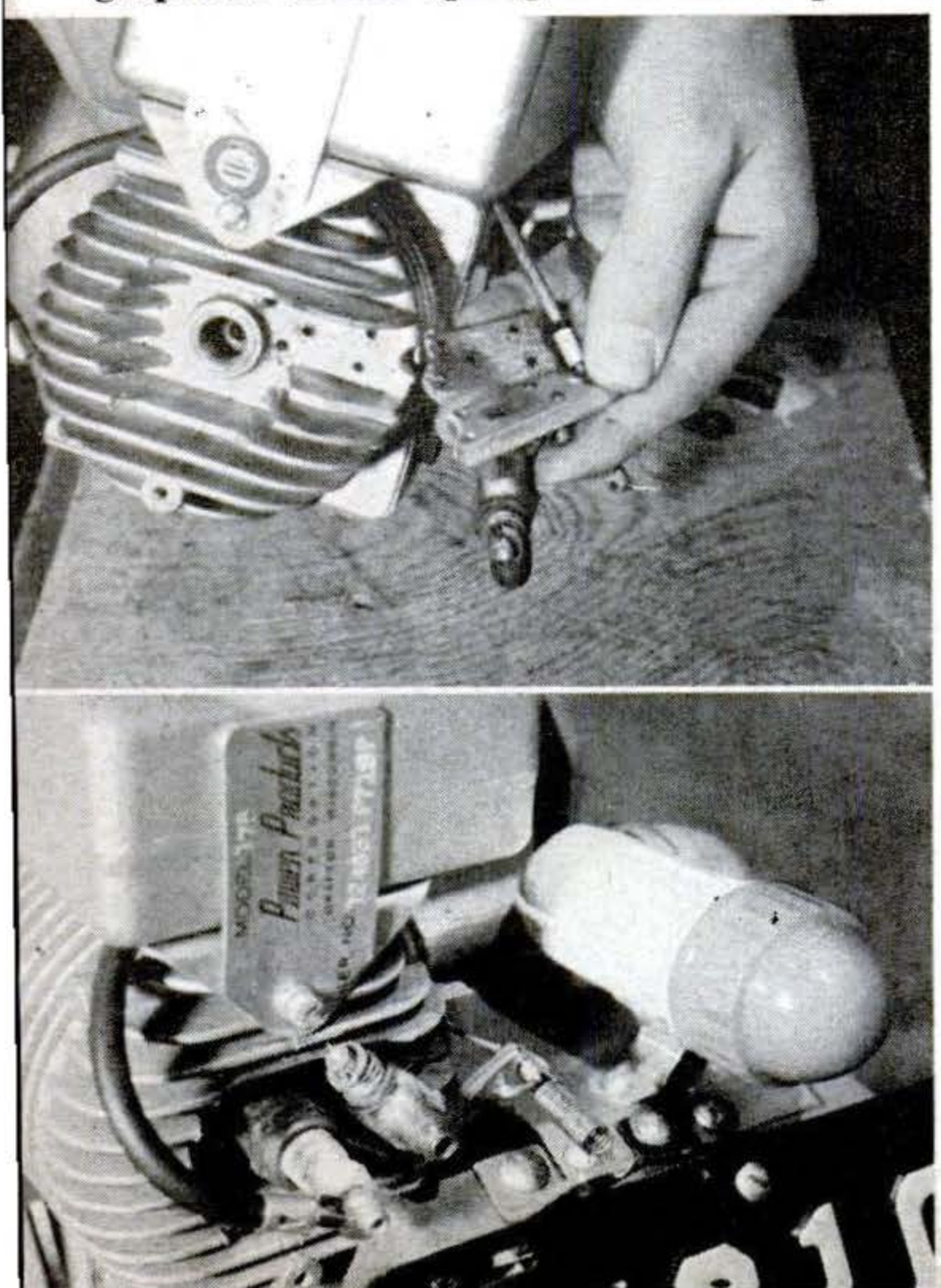
Compression release: plug-cock valve (⅛" pipe thread), ¼"-by-¾"-by-2¼" dural or brass plate.

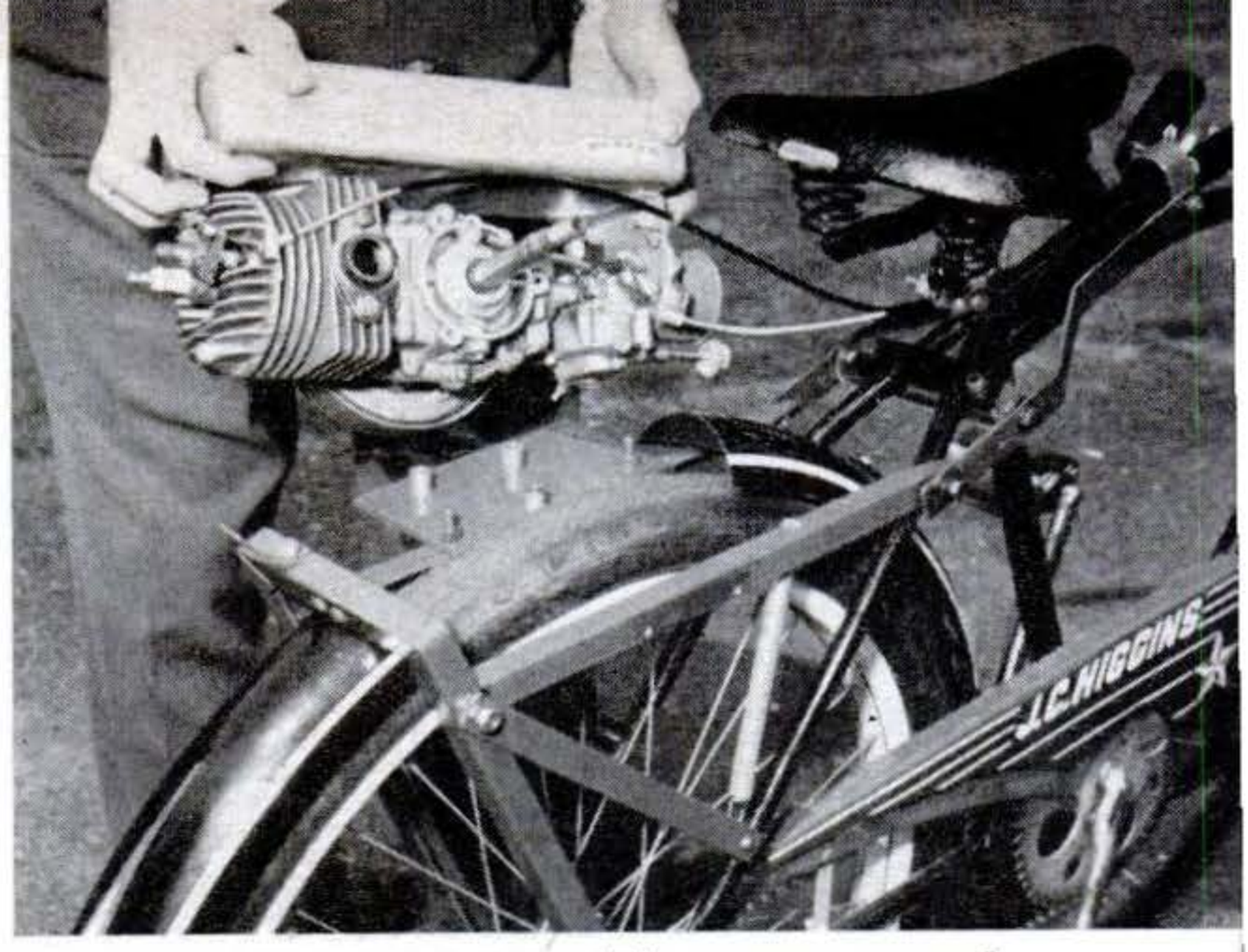
Frame stock: 5' of ⅛"-by-¾" angle iron, 3½' of ⅛"-by-1" flat iron, 2½' of ⅛"-by-¾" flat iron, 8" of ⅛"-by-1"-by-1" angle iron, 12" 1/16"-by-¾" strap iron, 12" of ⅜" pipe.

Engine plates: 3/16" dural or steel, 3½"-by-6" and 4"-by-5¼".

Miscellaneous: Two tension springs, ½" dia., 4" long; throttle and compression-release springs, elbow catch, rubber clutch grip, sheet metal for guard, ¼" bolts, nuts, lock washers.

COMPRESSION RELEASE makes starting easier. Cut two short fins off cylinder head as shown below. Space between plug and cylinder wall is too small to screw valve in directly, so it is mounted on a dural plate, and a hole is drilled in the head directly under it. Four holes are tapped 6-32 for mounting bolts. Cut gasket of exhaust-gasket stock. Take valve apart, clean off grease, lubricate with graphite. Mount spring as in lower photo.





WEIGHING ONLY 13 LB. with governor and blower removed, the engine rests on three spacers on a plate bolted to left engine mount. The roller (center photo) is a flat pulley, here shown with a radiator-hose sleeve cemented and screwed on it to increase

carded base and drill through it to spot the holes.

Making the roller. I first used a 1½"-diameter flat-belt pulley made of impregnated, compressed paper, with a rubber-hose sleeve over it. The hose was cemented on with Pliobond and further secured with three 6-32 screws, with star washers under them, at each end.

Later I switched to a 2" pulley of the same kind, without the rubber sleeve. This works well and has nothing to come loose. A similar cast-iron pulley could be grooved longitudinally to increase its driving friction.

The roller diameter determines your drive ratio (wheel size has nothing to do with it). If you live in hilly country, or want maximum pickup, you might try a 1½" roller. A 2" roller, however, makes the engine easier to start, and gives higher top speed and better gas mileage.

Aligning the roller. Check the required height of the engine shaft (roller diameter considered) above the tire. Then saw three spacers from ⅜" pipe and file the ends square to the required length. Mount the engine with ¼" bolts and lock washers. Be sure the bolts enter the threaded holes far enough to hold securely, but not so far that they hit bottom.

With the engine in place, the roller can be mounted on the shaft. The pulley I used has a metal hub, with a keyway and a setscrew. But my engine had no keyway, so I drilled and tapped the hub for a second setscrew 90° from the first, centered the roller over the tire, and spotted dimples in the shaft through the setscrew holes.

A vertical 3/16" plate is bolted to the

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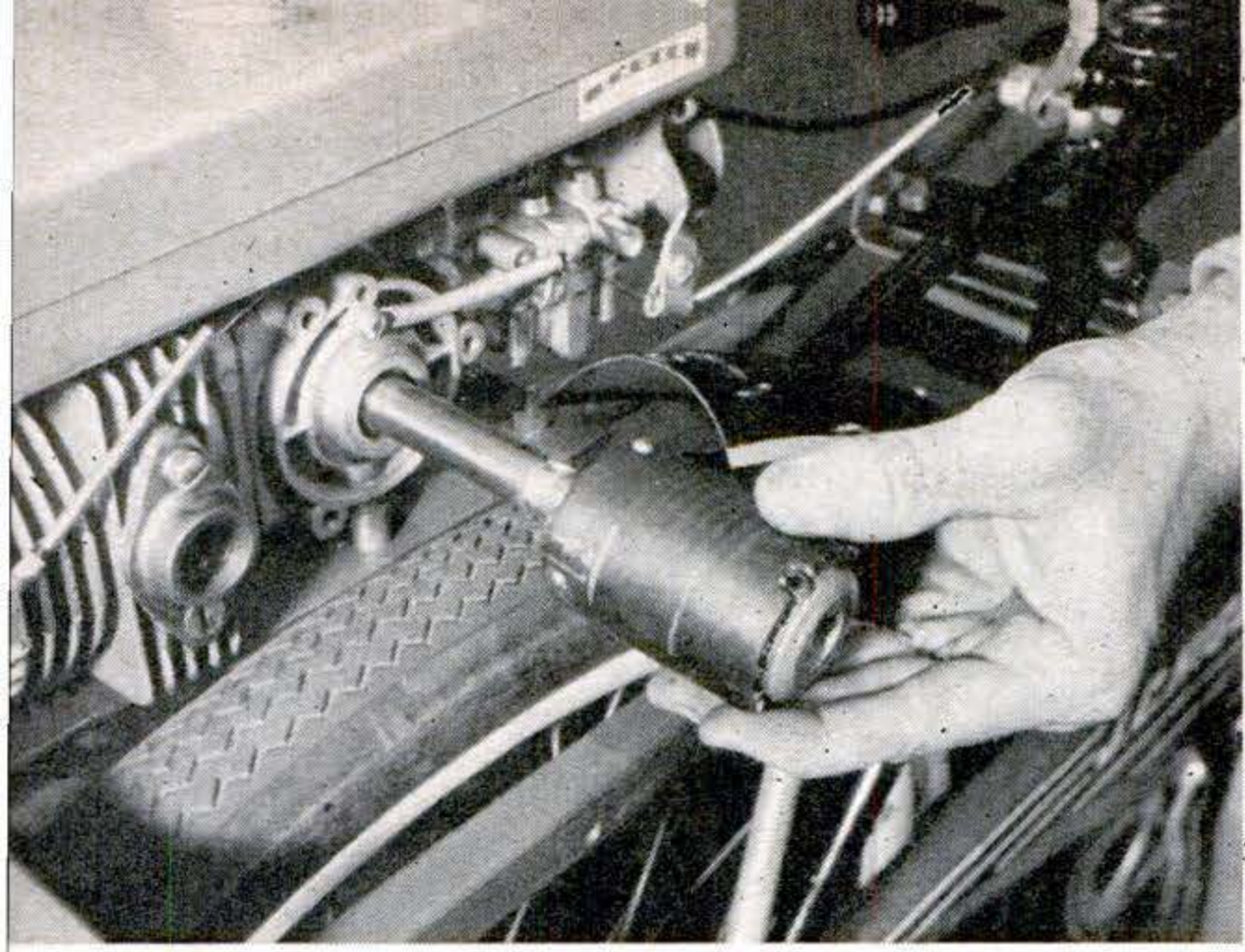
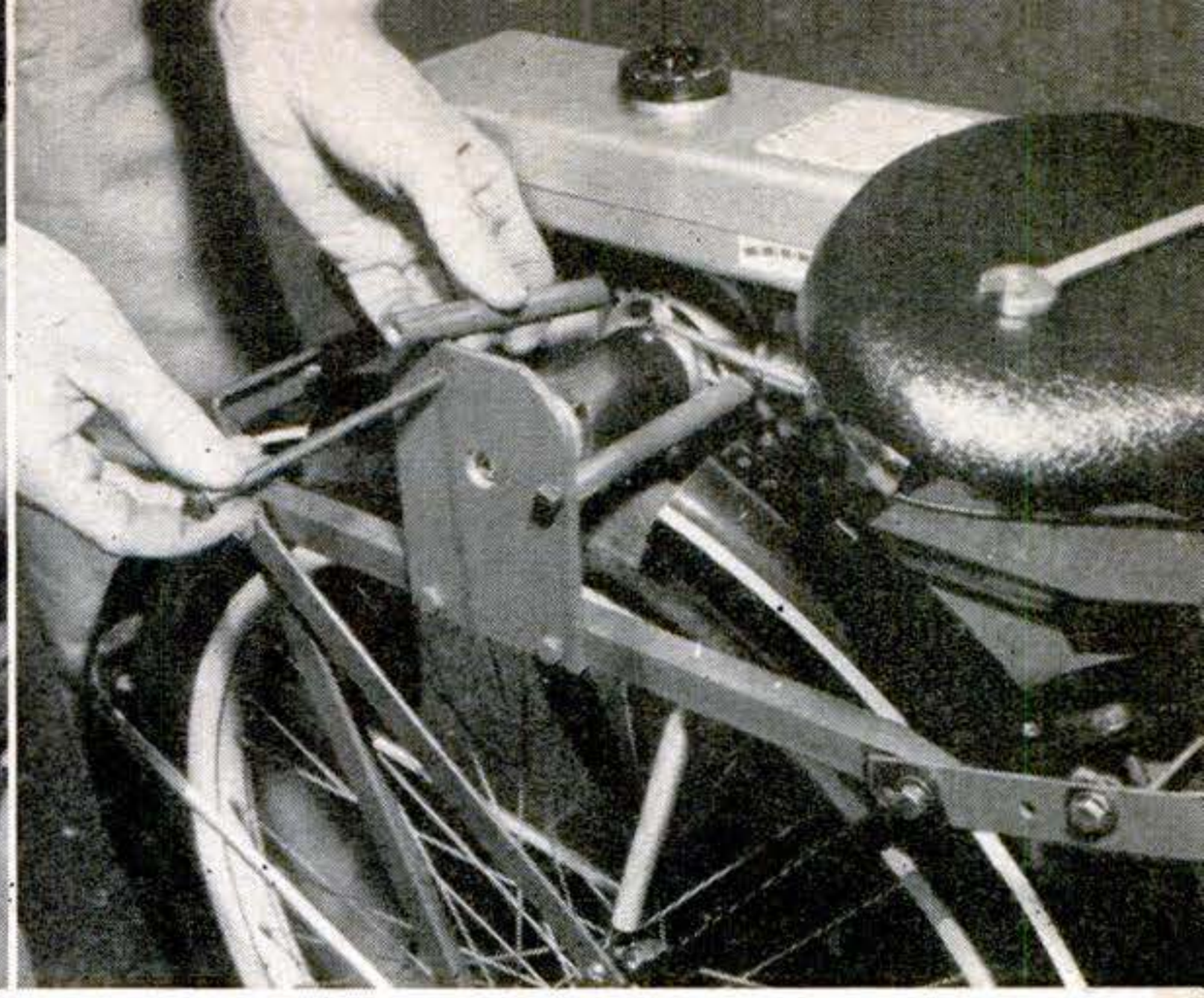




its diameter. A pulley of suitable size will drive without the sleeve. Note pipe flange fitted to exhaust port (above) and throttle return spring (over shaft). A 3/16″-by-4″-by-5¼″ plate (right, above) is bolted to the right-hand engine mount. Long bolts and spacers tie it to the engine crankcase. A strong spring on each side, hooked into a hole in engine mount and on the bolt holding the brace to the fork, pulls roller against tire. Adjust tension by moving brace. Bike wheel must rotate engine past compression.

right-hand engine mount. Long ¼″-20 bolts, with spacers on them, enter two of three tapped holes in the crankcase by which the governor cover was formerly attached.

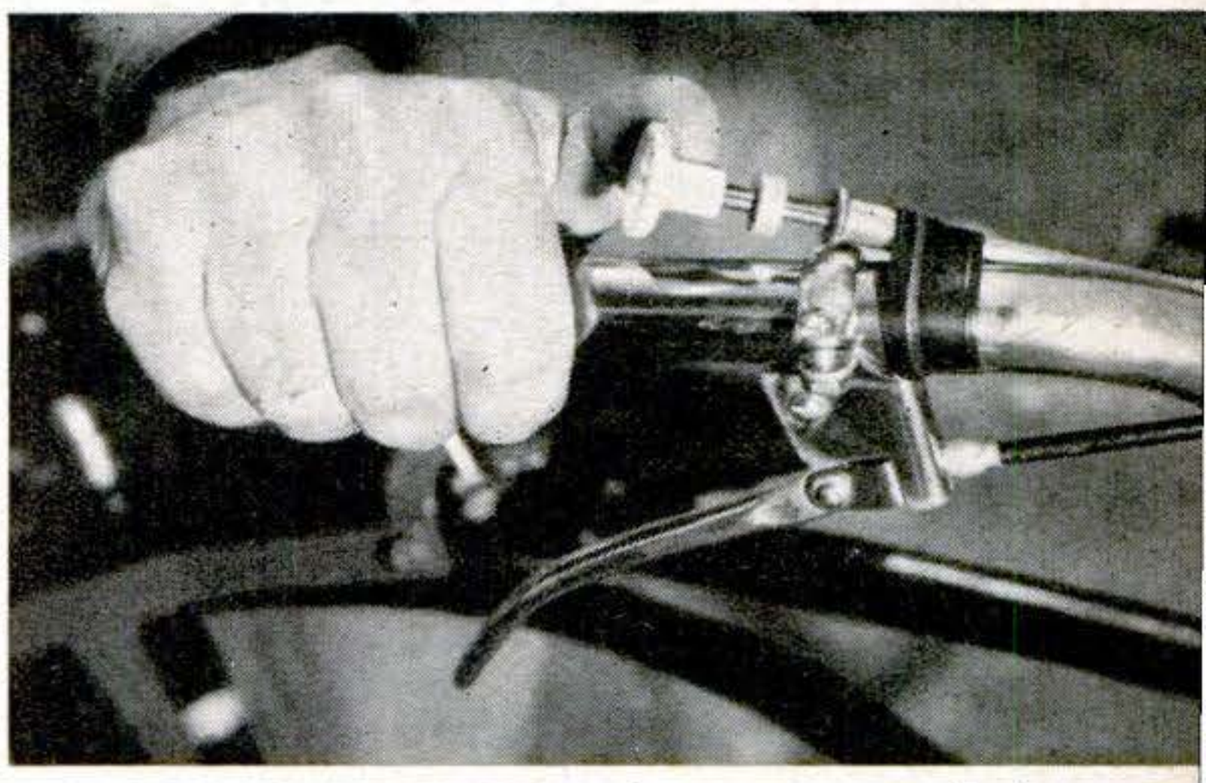
The controls. An auto choke cable on the right handle bar controls the throttle. No cable is needed for the choke; the rider can easily reach behind to open it after the engine warms up. However, I did add a compression release to make starting easier. This is a small plug cock (made for a compressed-air system) mounted on the cylinder head, with a control cable to it.

Try starting up without a compression release; you may not need one. If you do, take off the cylinder and cut off two of the short cylinder fins on one side of the spark plug with a coping saw, afterward filing the surface flat. As there is not room between the plug and the cylinder wall to screw in the valve itself, I mounted it on a small plate as shown on the facing page.

Guard and muffler. A roller guard, bent from light sheet metal, is bolted to the fender in front and the engine bracket in back as shown on page 148. Although mine ducks under the exhaust pipe, it could be run over it and even widened to enclose the pipe and muffler. The flywheel is a smooth bell without spokes or projections, and seemed to require no guard.

The original muffler would not clear the tire, so a ½″-pipe floor flange was cut down to fit the exhaust port, and a pipe nipple and elbow screwed on. As the original muffler had little quieting effect, I installed a bigger, more efficient one.

When starting out, drop the roller on the tire before starting to pedal. Open the compression release, start pumping, and when the flywheel is turning, close the release and open the throttle. To start up with the engine already running, disengage the clutch and pedal off; then let the clutch engage. Engaging it from a standing start will wear the roller unnecessarily. END

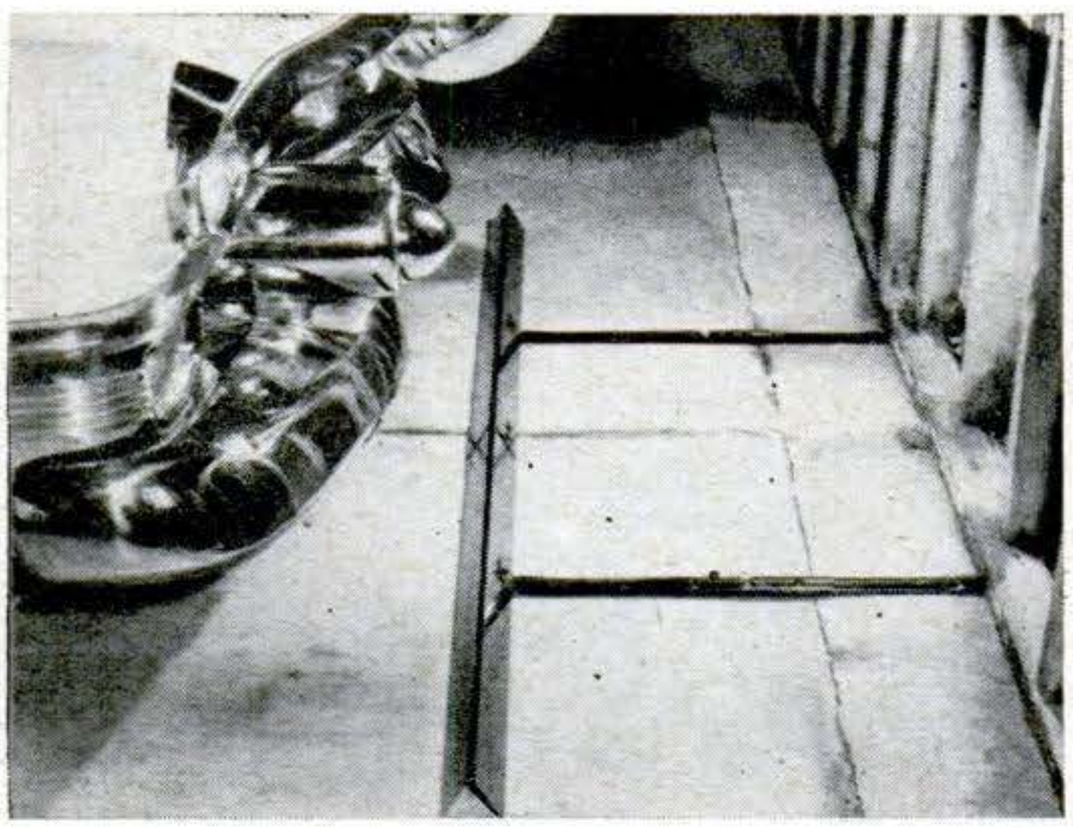


THROTTLE IS CONTROLLED by an auto choke cable run up the right handle bar. A small collar held by a setscrew adjusts idling position. The lever under the hand grip is for a front-wheel caliper brake, desirable with motor power to relieve coaster brake of some of its load. The compression-release control, a similar lever, is on left handle bar.

CLUTCH IS HELD in disengaged position by an ordinary cupboard elbow catch, fastened to the upper frame bar with two self-tapping screws or with 6-32 bolts in tapped holes.

New for Your Car

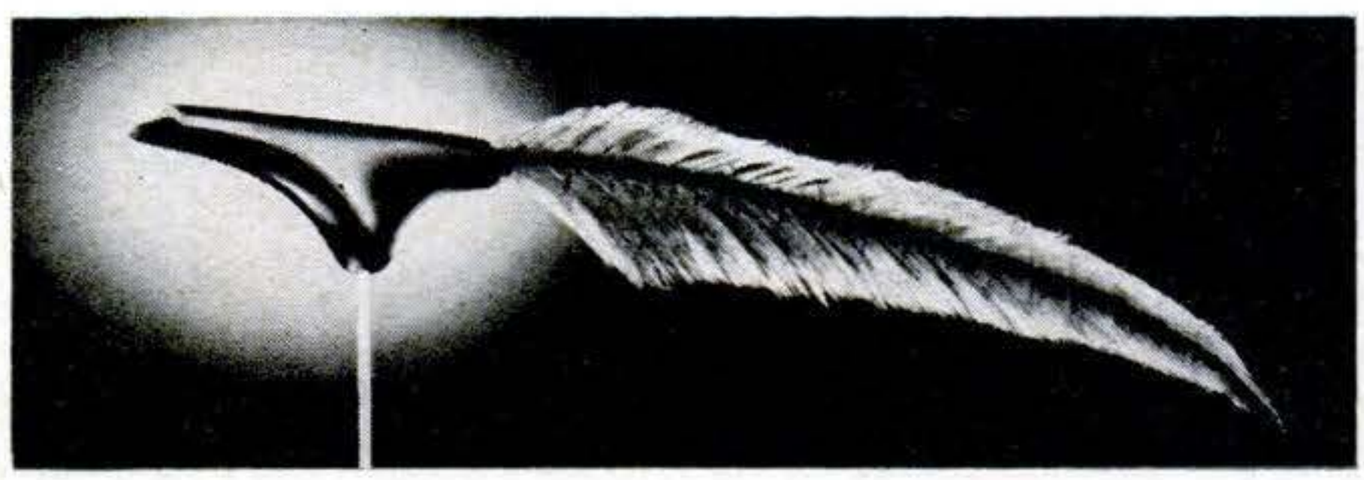
1. Car Cover Is Awning, Too. Pull this cover out of a roller attached to your car's rear bumper to protect it from the elements. Release it, and it rolls itself up. A broad awning and supporting arms fitted with suction cups that grip the side of the car can be added to provide a shady spot or dressing tent at the beach.



2. Wheel Stop Protects Garage Wall. Drive that long new car all the way into the garage and stop a fraction of an inch from the wall with the help of this adjustable wheel stop. Extend it so the wheels hit the stop bar just before the bumper touches the wall, to provide maximum clearance at the back end for closing the garage doors.

3. Car Necessities Are Combined in Kit. This neat vinyl plastic case holds an assortment of handy objects for your car. It contains a whisk broom, windshield scraper and cleaning cloth, bottle opener, comb, pencil, screwdriver, sewing kit and a small flashlight. When closed, the kit fits compactly in the glove compartment.

4. Feather Identifies Car. You'll locate your car instantly among hundreds of others in a crowded parking lot if it flies this brightly-colored pheasant feather on its antenna. The feather also indicates the wind direction when the car is standing still.



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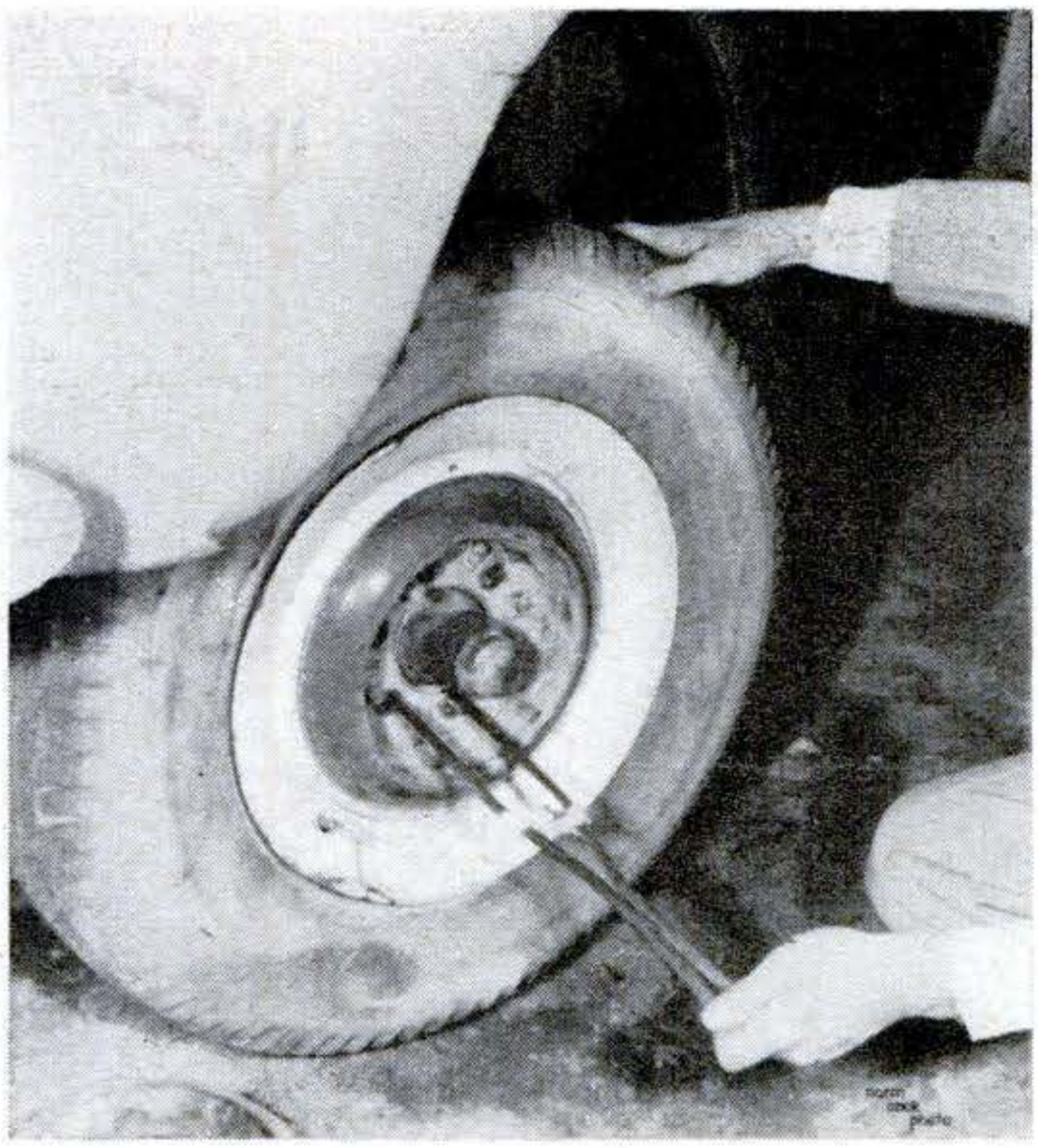
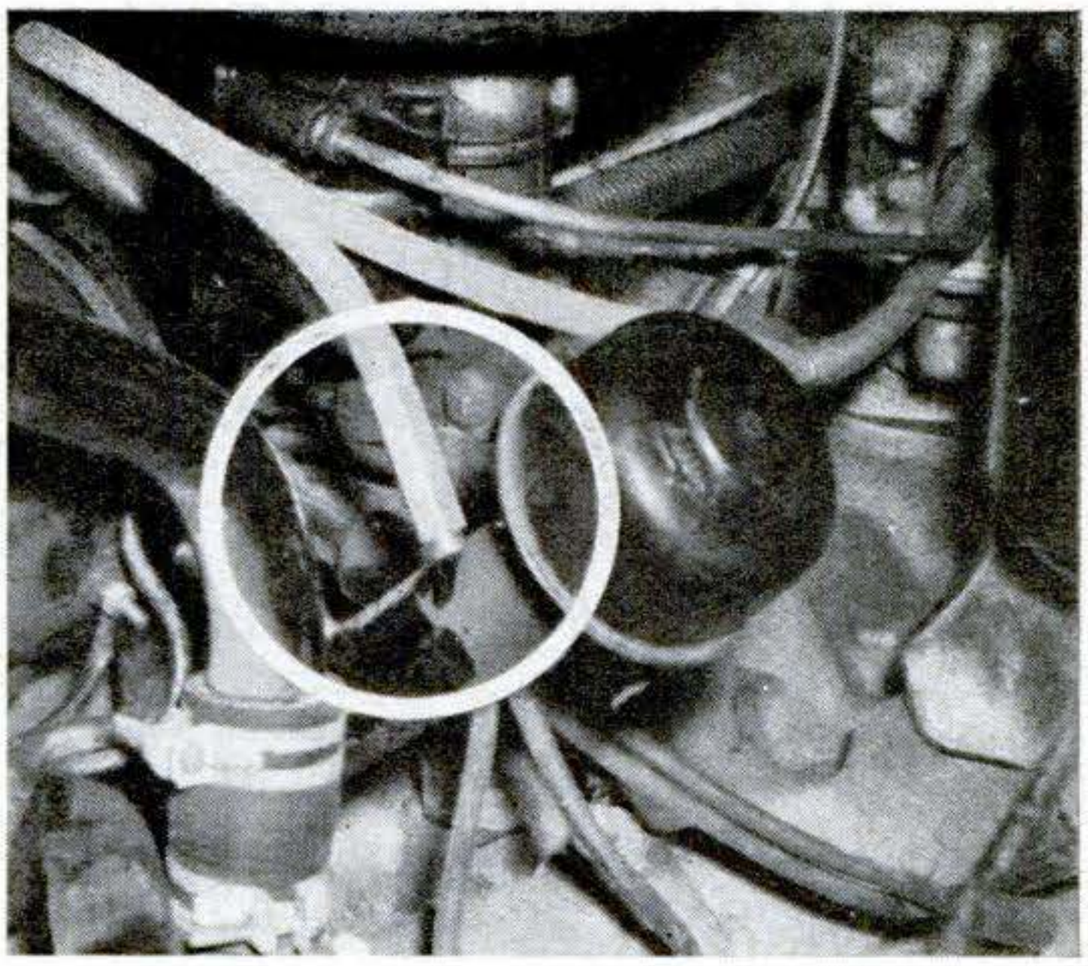
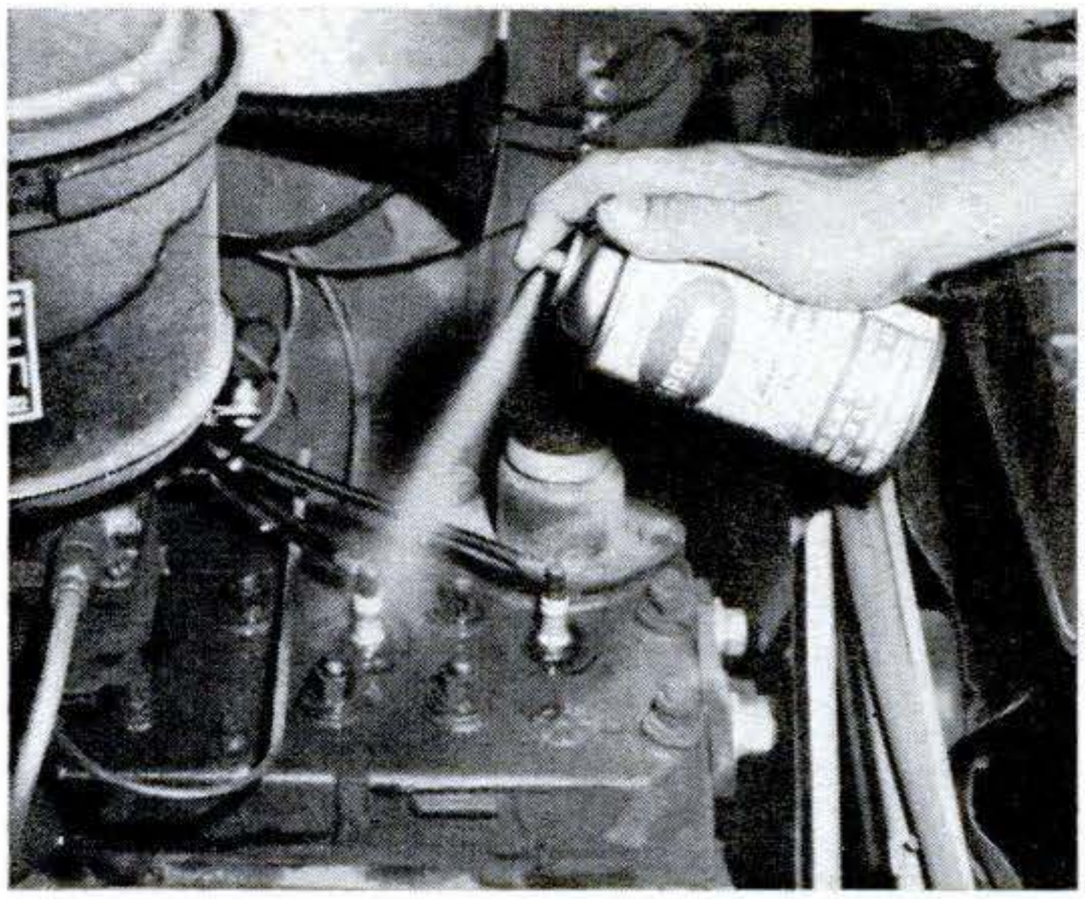


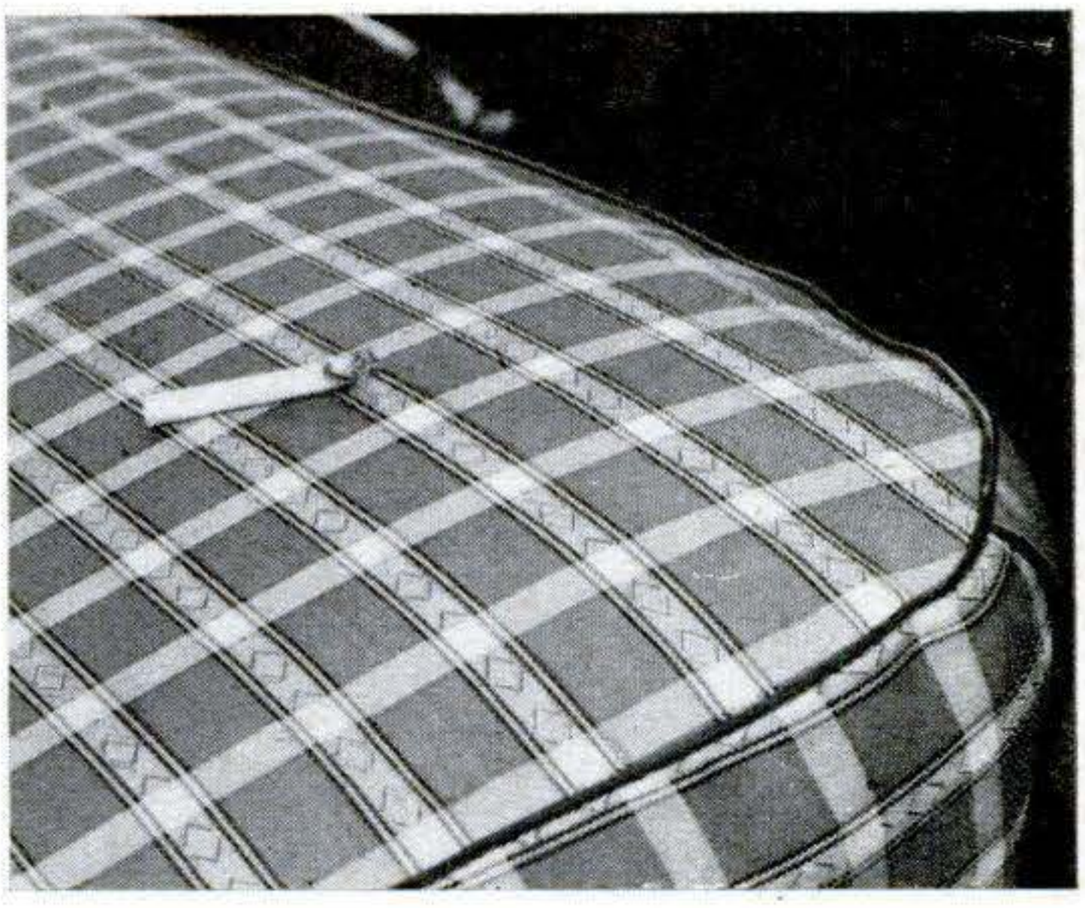
5. Lever Lifts Wheel on Drum Lugs. Put your spare wheel on without effort next time you get a flat. This wheel lifter centers it and slides it up on the lugs in one motion. It can be used on drums having holes for bolts, or on the type with studs.



6. Attachment Draws Vapors from Crankcase. Installed on the crankcase breather pipe or overhead-valve cover, this unit draws sludge-forming vapors out of the crankcase and delivers them to the intake manifold to be burned away with the fuel mixture. The manufacturer claims that it extends the useful life of the oil and filter, and adds light lubrication to the tops of the cylinders and valve stems.



7. Spray Dries Wet Ignition. Differing from insulating spray that keeps water out of a car's ignition system, this chemical is sprayed over the electrical equipment to drive the wetness out. It is claimed that a water-soaked circuit can be put in service a few minutes after spraying, and that the application will protect the system for several months after. The solution can also be used to coat tools against rust.



8. Seat Covers Resist Burns. Sparks from a cigarette, or even a lighted match accidentally dropped on the seat, won't burn holes in these seat covers. The fabric is impregnated with a special resin, which the manufacturer claims releases a flame-smothering gas when heated. The covers are woven of the same material used to make tire casings and are said to be static-free and impossible to tear.

Further information on these new car products can be obtained from: 1. Roll-On Car Cover, Inc., 1610 N. Wilcox Ave., Hollywood 28, Calif.; 2. Arthur H. Kitson, Inc., 20818 Harper Ave., Detroit 36; 3. Zoe Steele, 10 E. 39 St., NYC 16; 4. Gerard Industries, Inc., 2268 Albion St., Toledo 6, Ohio; 5. Wheel Lifters, Inc., 1900 Main St., Boise, Idaho; 6. Precision Products Co., Harvard, Ill.; 7. Spradri Co., 332 Atando Ave., Charlotte 6, N.C.; 8. Banner Mfg. Co., Inc., 37 Preston Court, Brooklyn 34, N.Y.

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Your Shop Can Save

Sprucing up the old homestead yourself can put dollars in your pocket—and be fun, too!

DO YOU think of a workshop as just a place to play? Ideally, it's most relaxing that way. But there are times when a shop justifies its existence in a more material way. Storm windows, screens and other home improvements that come out of a shop can make it a source of pride—and dollar savings—for the entire family instead of just a place where Dad secludes himself to putter around.

Most impressive—and often easiest to

Put a Radiator

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You Money

make—are things that dress up a home. Below is the first of four projects that can be made in any workshop—from the most elaborate, down to the small bench and rack of hand tools—and they'll give a reputation to both you and your shop. Remember, too, the dollars you save can go toward new equipment to help you save even more.

Under Cover for $3

Wire lath, shelving and strips of molding go together to make this attractive radiator cover.

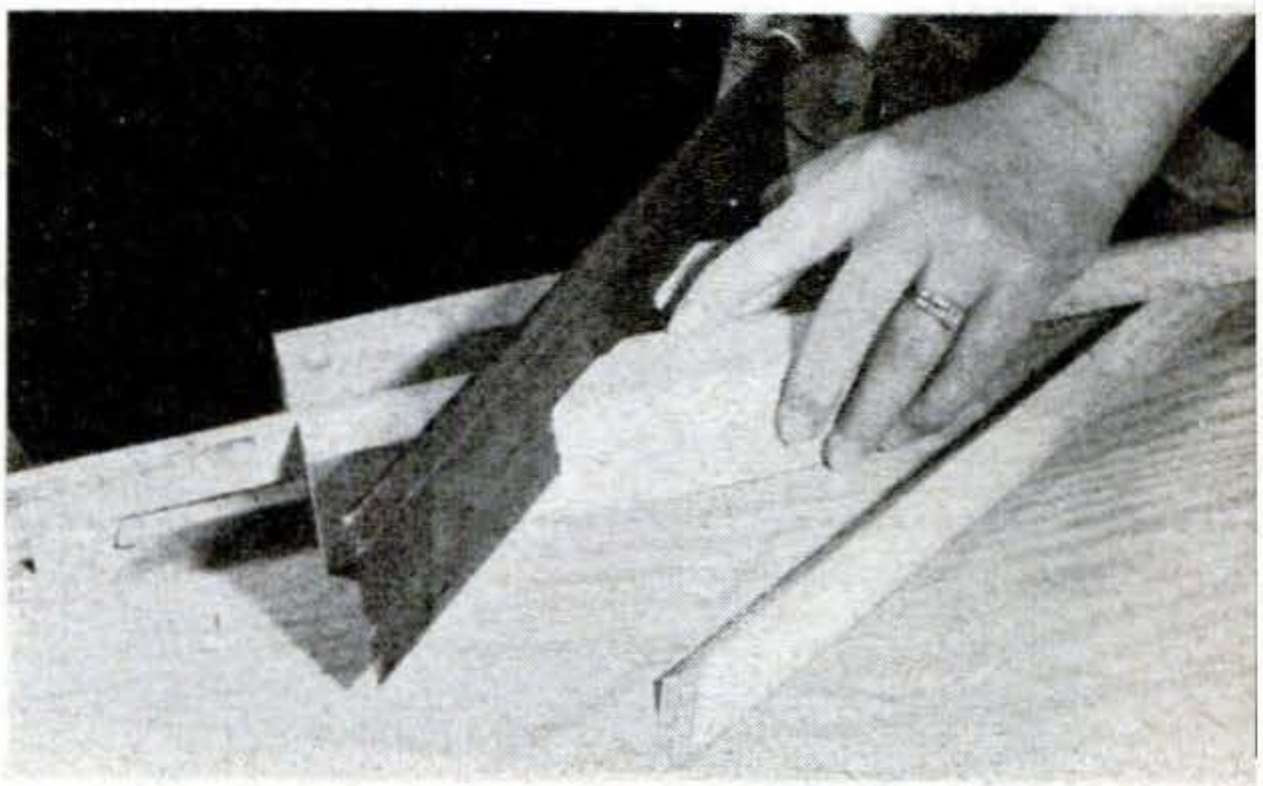
MADE without elaborate carpentry or framing, this radiator cover provides a rainy-day play surface for tots and keeps them away from the hot metal.

Nail quarter-round molding to the floor around the radiator and bend a piece of wire lath—the expanded type used by plasterers—to fit snugly inside it. Cut two strips of one-by-two and nail them inside the vertical rear edges of the lath to stiffen them. Bend the sharp ends over the one-by-two strips to get them safely back against the wall.

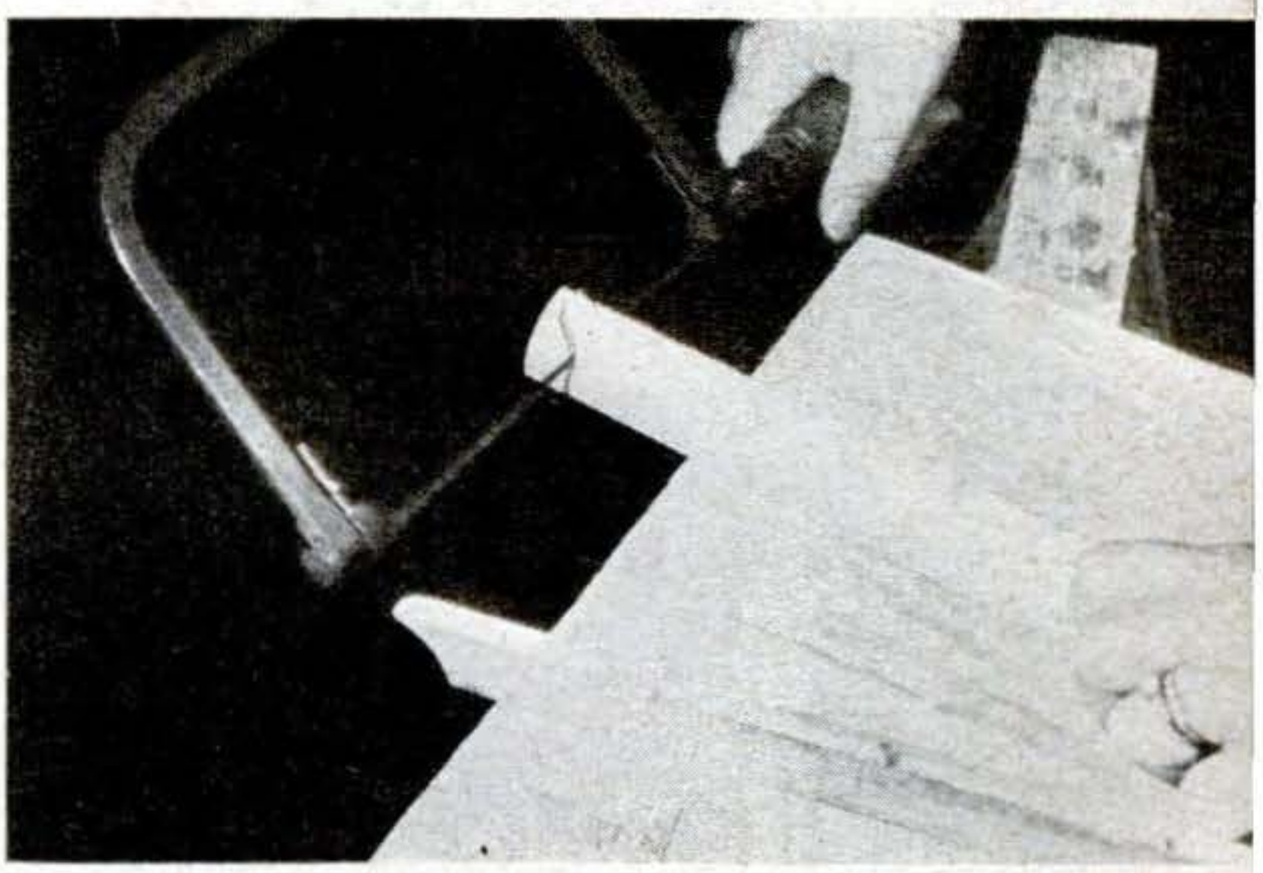
Place the lath in position around the radiator and cut the top from shelving or ¾″ plywood to fit over the top edges. Nail 1″ half-round molding to three sides of the top, leaving the extra ¼″ projecting below the bottom surface to retain the lath.

When you're satisfied that all is square and level, fasten the top to the wall or window apron, using one of several methods shown on the following page, so that the cover can be removed for cleaning inside.

Paint the base molding and shelf to match the woodwork in the room. The wire lath comes finished black and need not be painted, but if you decide to finish it, too, you'll find a paint spray bomb much easier for the job than a brush.—*Elizabeth H. Wagner, White Plains, N.Y.*

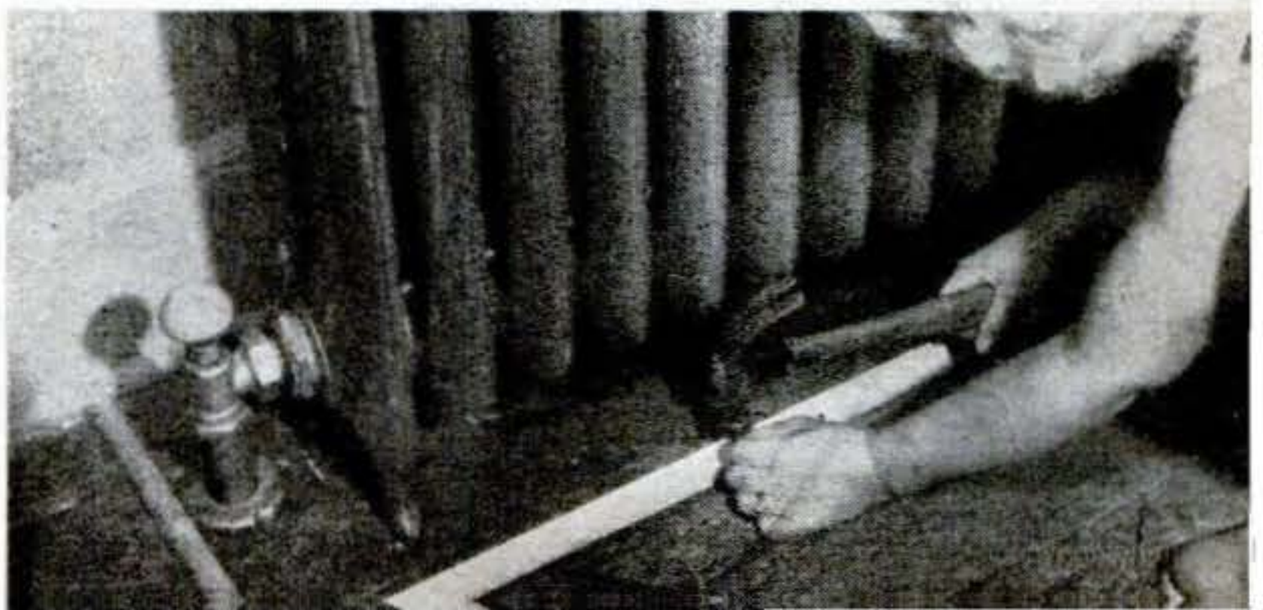


USE MITER BOX to cut neat, tight-fitting 45° corners in quarter-round molding.

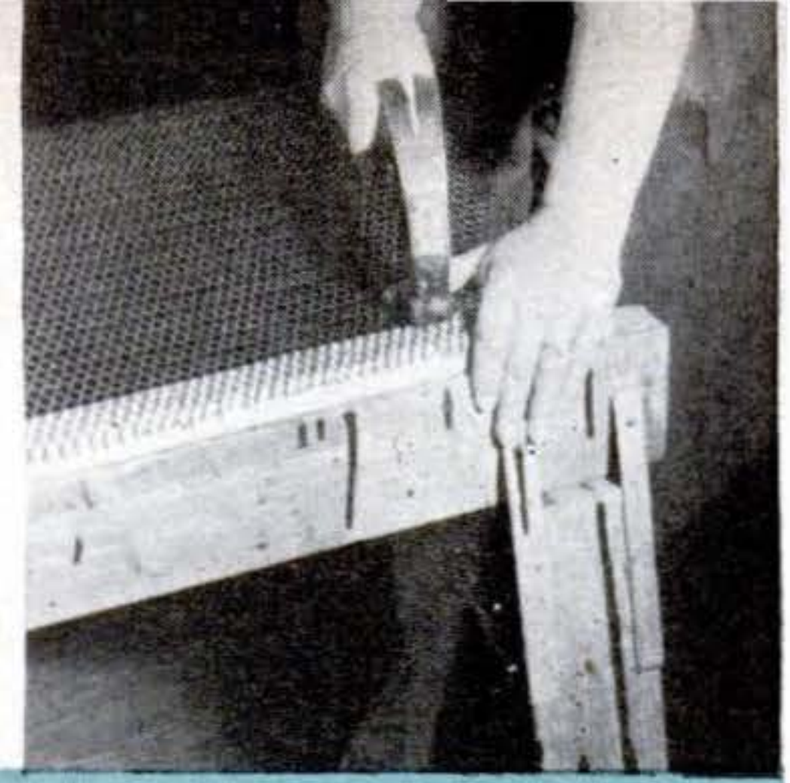


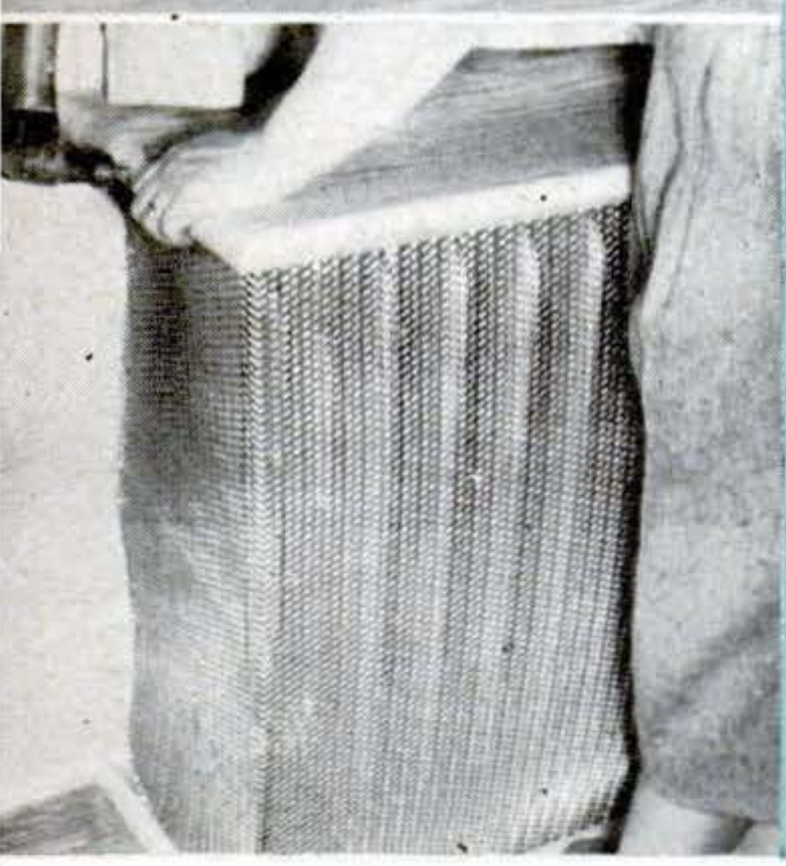
SHAPE WALL ENDS of sidepieces to fit snugly against baseboard. Coping saw does the job.

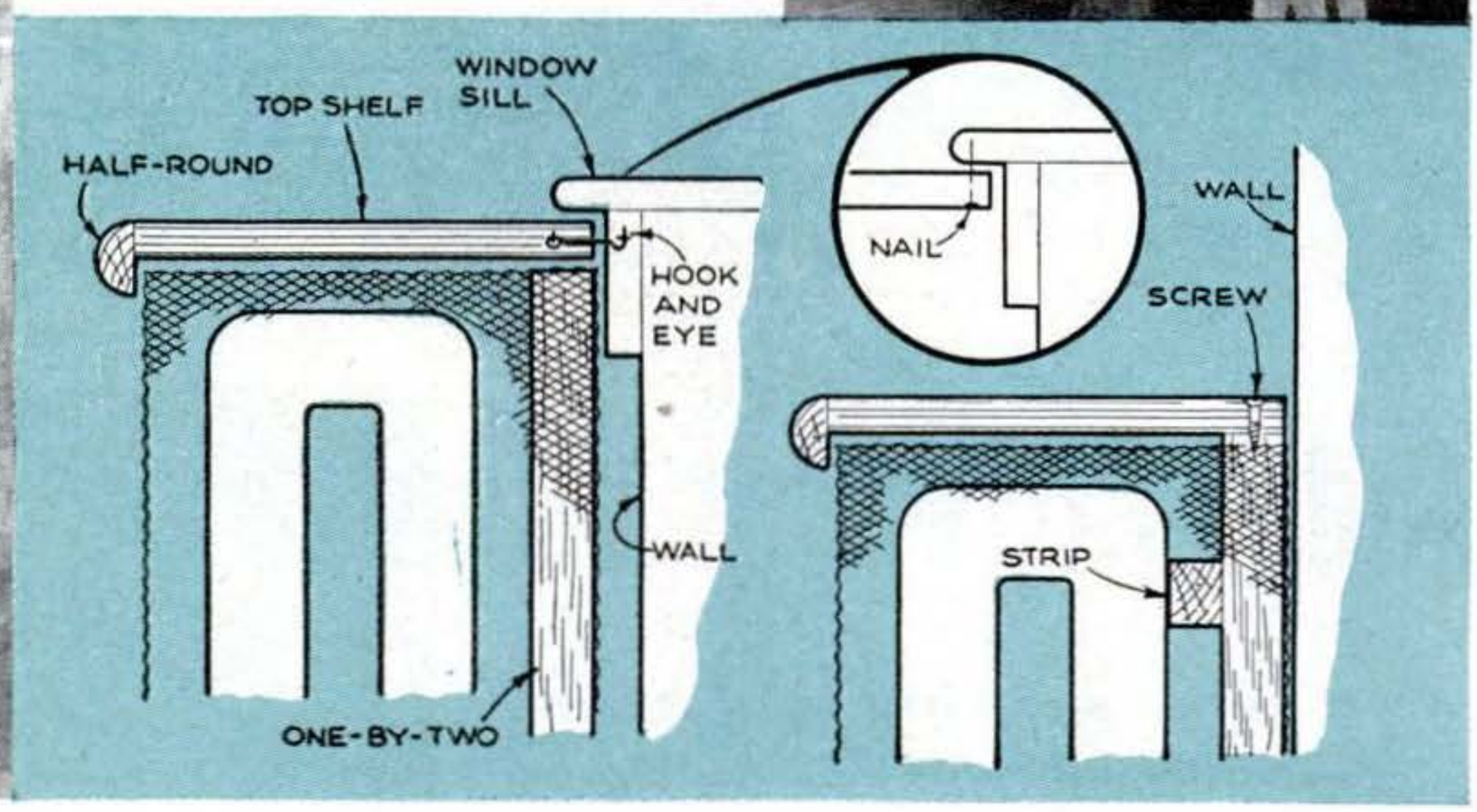
NAIL MOLDING TO FLOOR around radiator to keep lath from sliding out at the bottom.



BEND WIRE LATH around edge of board to get crisp corners (left). Nail rear edges to strips of one-by-two and bend sharp ends of wire over (right). Set top on lath and job is practically complete (lower left). Drawing below shows several methods of fastening top to the wall or window apron.







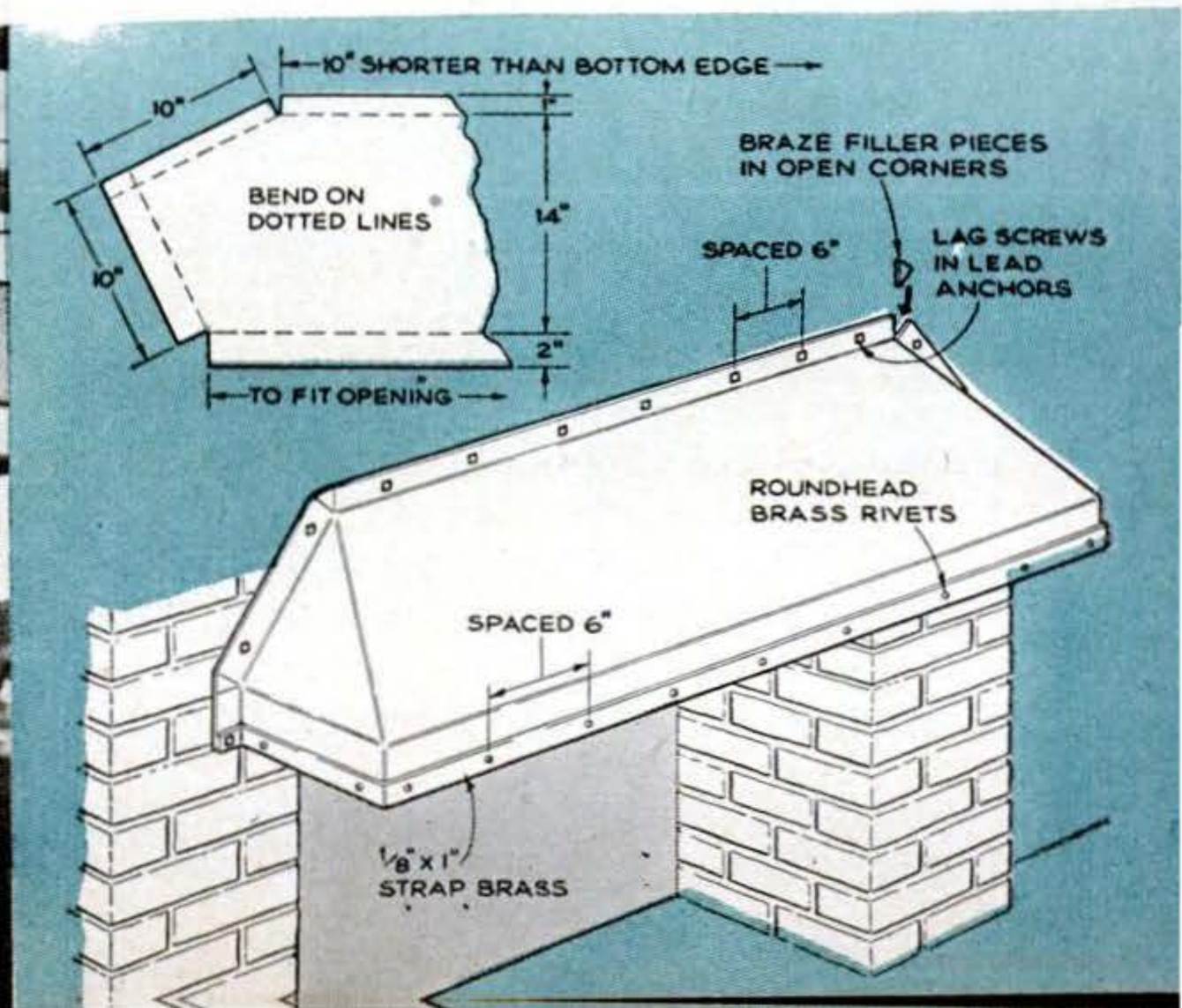
Make a Copper Hood to Dress Up Your Fireplace

This hood can work wonders for your draft-dodging fireplace. It's mighty good-looking, too.

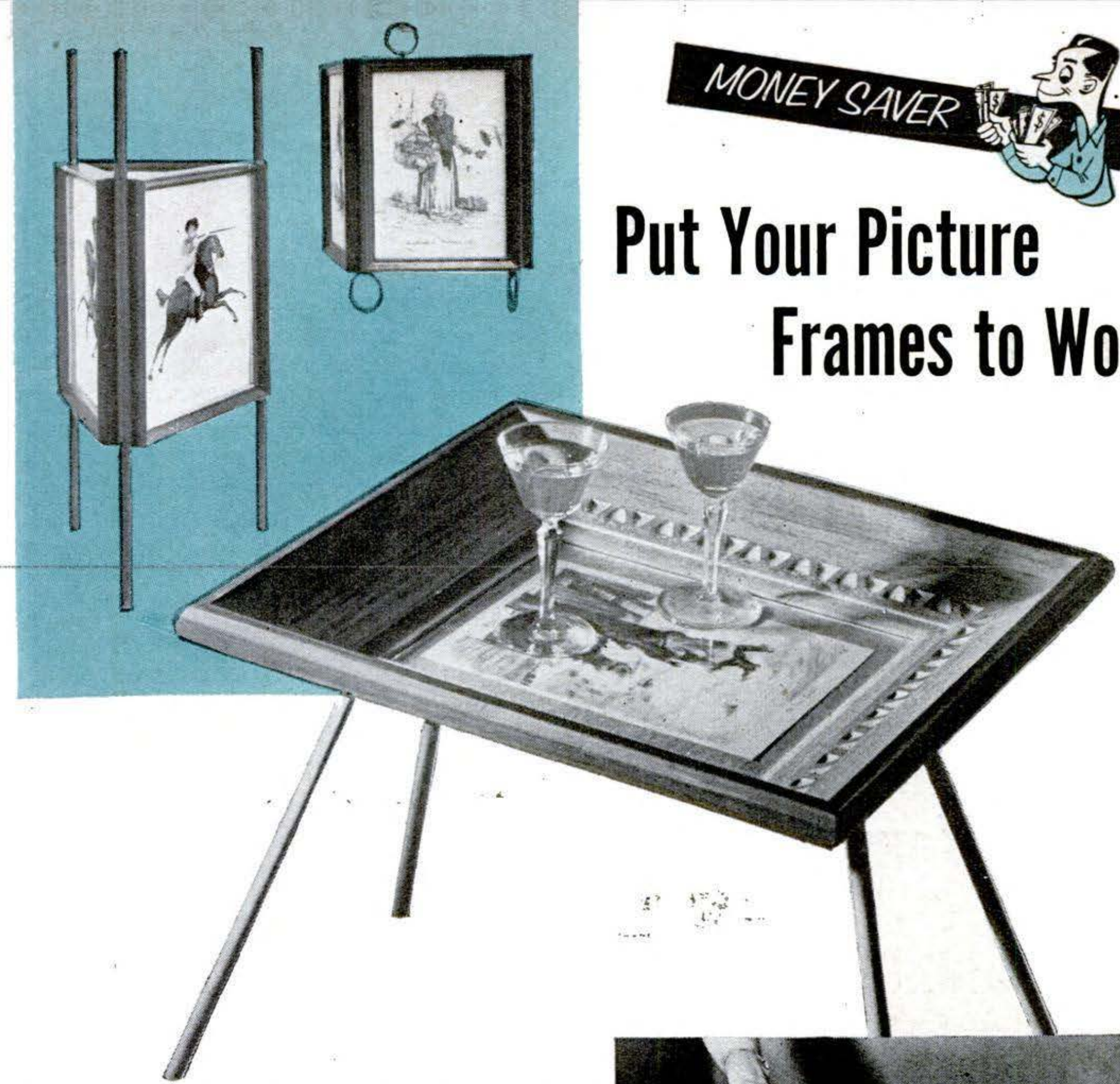
A GLEAMING copper hood will certainly improve the appearance of a large fireplace, but more important, it will increase the draft, making the fire burn cleaner.

Make it from a sheet of copper at least 1/32″ thick, cut and bent to fit over the opening. Bend up a flange on the three edges that fit against the brick and braze a piece of copper over the gap in each top corner of the flange. Bind the overhanging edge with ⅛″ strap brass.

Hang the hood over the fireplace opening with lag screws set in lead anchors. —*Hi Sibley, Nuevo, Calif.*



Put Your Picture Frames to Work

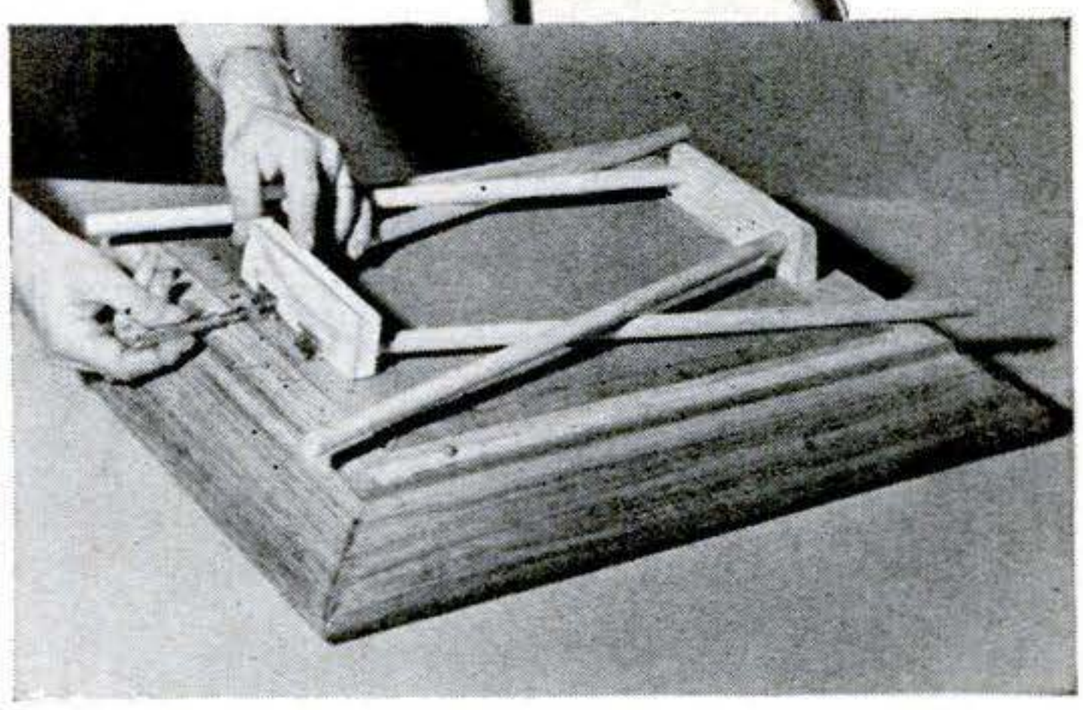


Save those old pictures! You can serve drinks off them, make a wastepaper basket or a lamp.

THOSE pictures just hanging on the wall can be put to practical use and still decorate a room. These ideas show how you can make framed pictures into charming room accessories. One idea gives a picture a double purpose: an occasional table for tea or cocktails, which can be folded and hung out of the way on the wall . . . as a picture.

Choose a picture in a heavy frame for conversion to a table. Make legs by gluing ¾″ dowels in holes drilled at a slight angle in beveled wood blocks. Attach the blocks to the back of the frame with hinges so that the legs will fold flat against it. The legs should be about 15″ long, shorter if they extend beyond the edges of the frame when folded.

Use four frames of the same size and shape for the wall lamp. Assemble them into a square by gluing or nailing the inside edges to cleats. Remove the picture from the frame that rests against the wall and replace it with a piece of ¼″ plywood. Screw the light fixture to the plywood and attach the hanging ring to the top edge of the rear frame. Screw a ring at each lower corner of the front frame to trim it off.



LEGS, glued into beveled blocks, fold flat on hinges so table can be hung on the wall.

Join three identical frames on three 18″ lengths of ½″ dowel to make the off-the-floor wastebasket. Attach the dowels to the edges of the frames with glue and nails. Fit a triangular piece of plywood inside the frames at the bottom to complete the basket. Lacquer the dowels to match frames and finish off the tops by driving rubber-headed tacks in the dowel ends.

Please turn the page for more money-saving ideas.

Copyrighted material

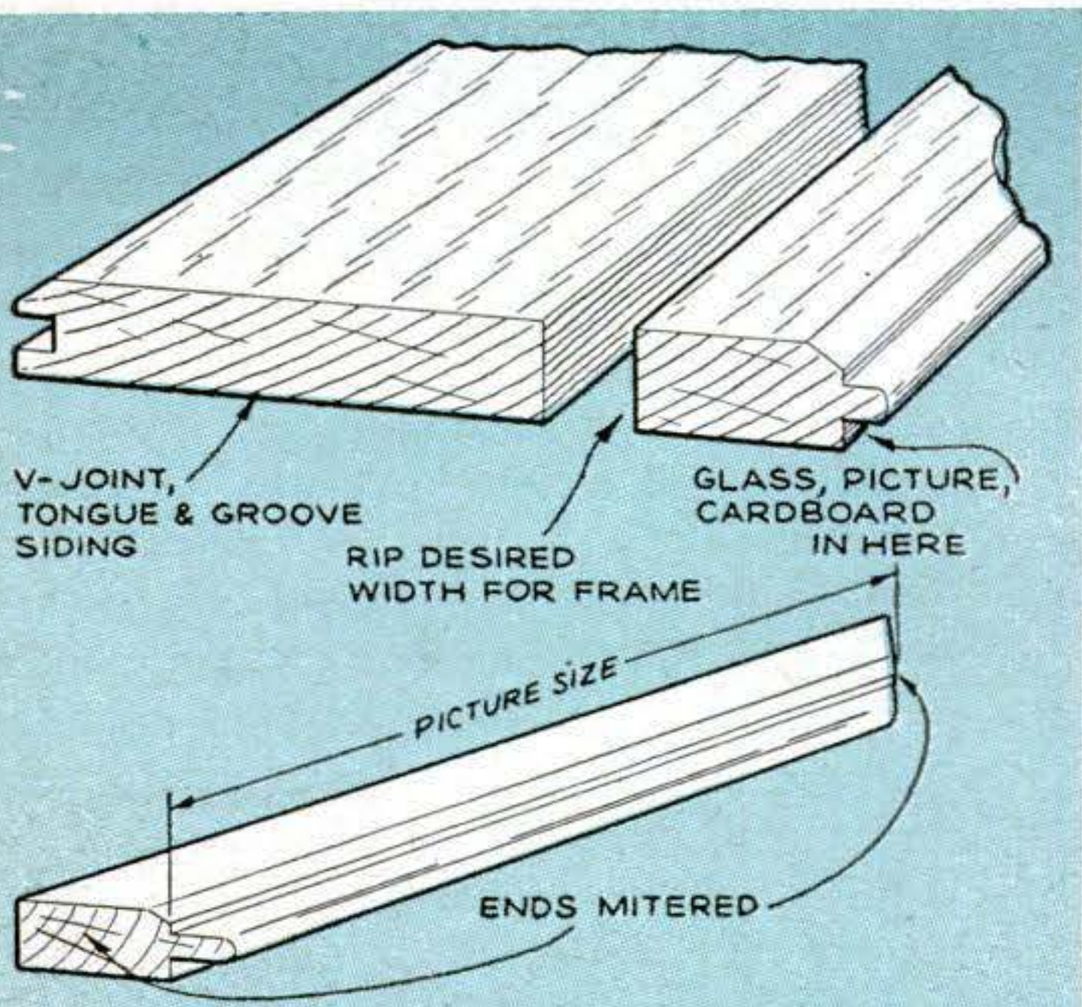
Frame Your Pictures with Siding

The tongued edge makes perfect picture-frame molding. All that you have to do is cut it to size.

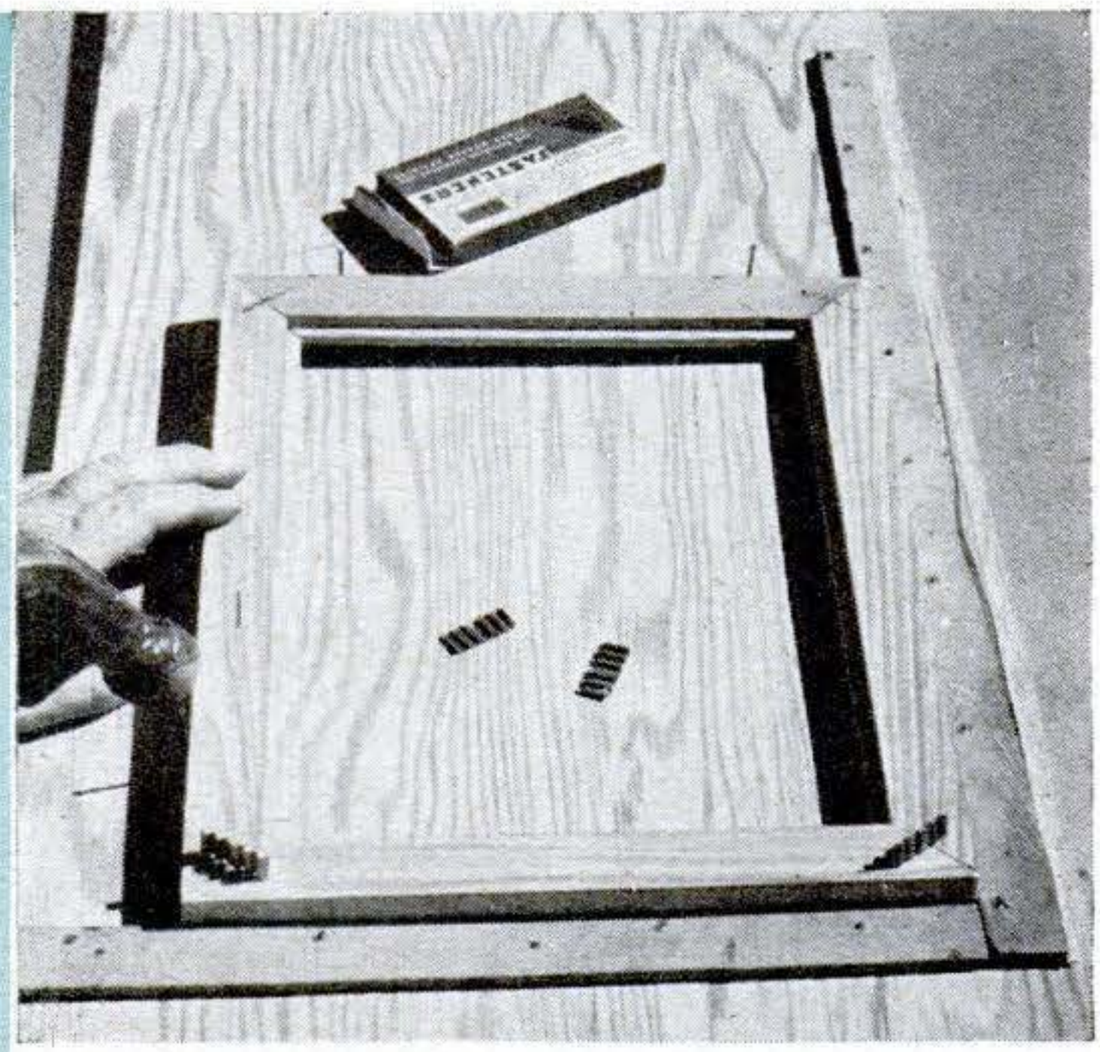
SHORT ends of V-joint tongue-and-groove boards cost you next to nothing. The underside of the tongue is already rabbeted deep enough for a picture, glass and backing board. The top beveled surface and rounded edge of the tongue resemble a decorative molding.

Rip the boards to the desired width and cut the ends in a miter box, measuring along the inside edge of the rabbet when cutting to length to fit picture. Make an assembly jig by nailing two strips of plywood to a flat board. Use a framing square to be sure the two strips are nailed at 90° to each other. Lay the frame pieces in the jig face down, pressing the top and one side against the plywood strips. If the parts are cut accurately, the bottom and opposite side should fit squarely against them. Drive nails into the board to hold the frame together while you drive a corrugated fastener across each joint.

Sand the face and edges smooth and finish as desired. Insert the picture, with or without glass, as you prefer, and cardboard backing. Glue wrapping paper over the back to give the job a professional touch.—*Leslie P. Young, Sarasota, Fla.*



THIS IS V-JOINT SIDING. Rip off tongued edge to width needed for picture frame and use it just as it is. When cutting to fit picture, measure along inside of rabbet, not edge of tongue. Miter pieces accurately, or frame will not be square.



ASSEMBLY JIG helps put the frame together. Plywood strips hold top and one side square while the bottom and opposite side are fitted to them. When entire frame is square, drive nails into the board to hold the two loose parts in place while corners are fastened with corrugated metal fasteners.

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New for the Handy Man

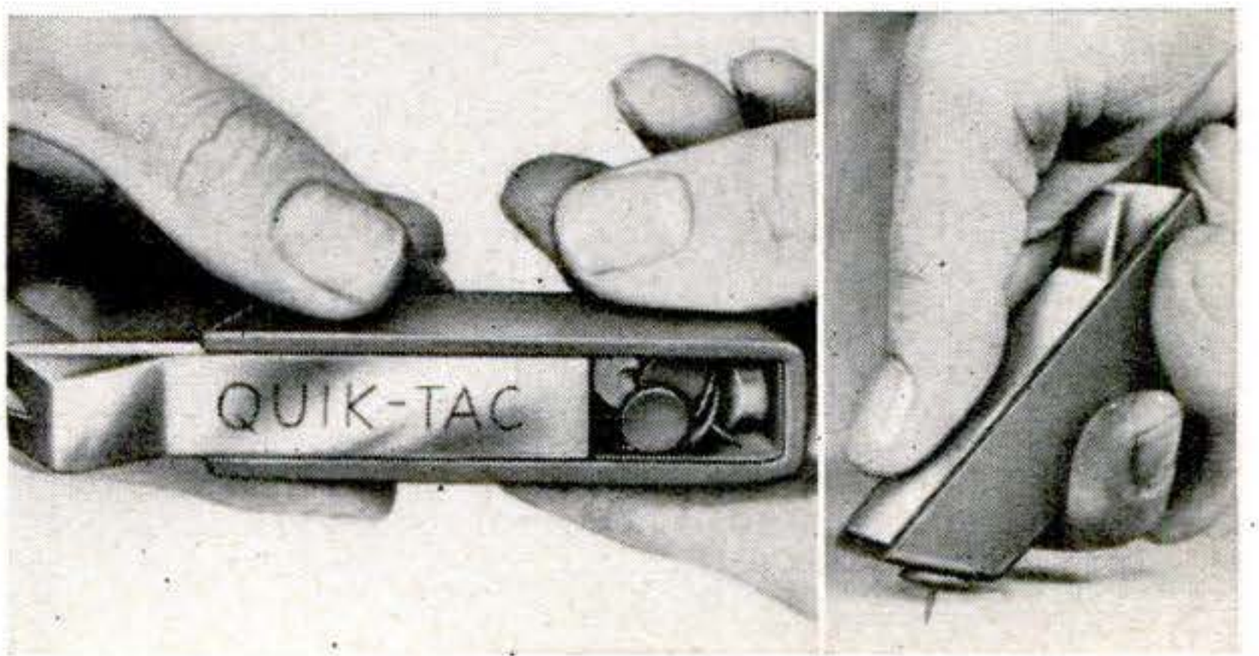
1. Electric Drill Starts Mower Engine. Instead of yanking a starting rope, mower owners can now start their engines with an attachment that fits in the chuck of an electric drill. The device engages a cone pulley, which is attached to the crankshaft, spinning the mower engine until it starts.

2. Lawn-Sprinkler System Is Permanent. Packed as a kit, to be fitted and installed in lawns of any size and shape, this sprinkler ends dragging out a hose for watering the grass. Eight sprinkler heads, set flush in the ground, cover a large area.

3. Utility Hook Has Many Uses. Shown here supporting a garbage can out of reach of dogs, this handy hook can also serve as a hanger for garden tools, fire pails, coils of wire, clothesline and laundry bags. Three screws anchor the hook securely wherever you need it.

4. Wand Kills Weeds. Fill this clear-plastic tube with weed-killing solution and eliminate dandelions, thistle and other pests from your lawn. Press the lower end of the tube over the weed center. A sponge tip saturates the weed without harming nearby plants.

5. Tack Puller Drives 'Em, Too. One end of this tacking tool has a magnetic surface that grips the head of a tack for easy driving (far right). The other end has a slide-out claw that pulls tacks and deposits them inside the holder for re-use.



1. Flint Engineering Co., P.O. Box 605, Flint, Mich.; 2. Plastipipe, Inc., 5544 W. 164 St., Los Angeles; 3. Engman Mfg. Co., 1317 Locust St., Des Moines, Iowa; 4. Gro-Quick Sales, 10342 Lanark Ave., Detroit 4; 5. Osrow Products Co., Inc., 95-10 218 St., Queens Village 29, N.Y.

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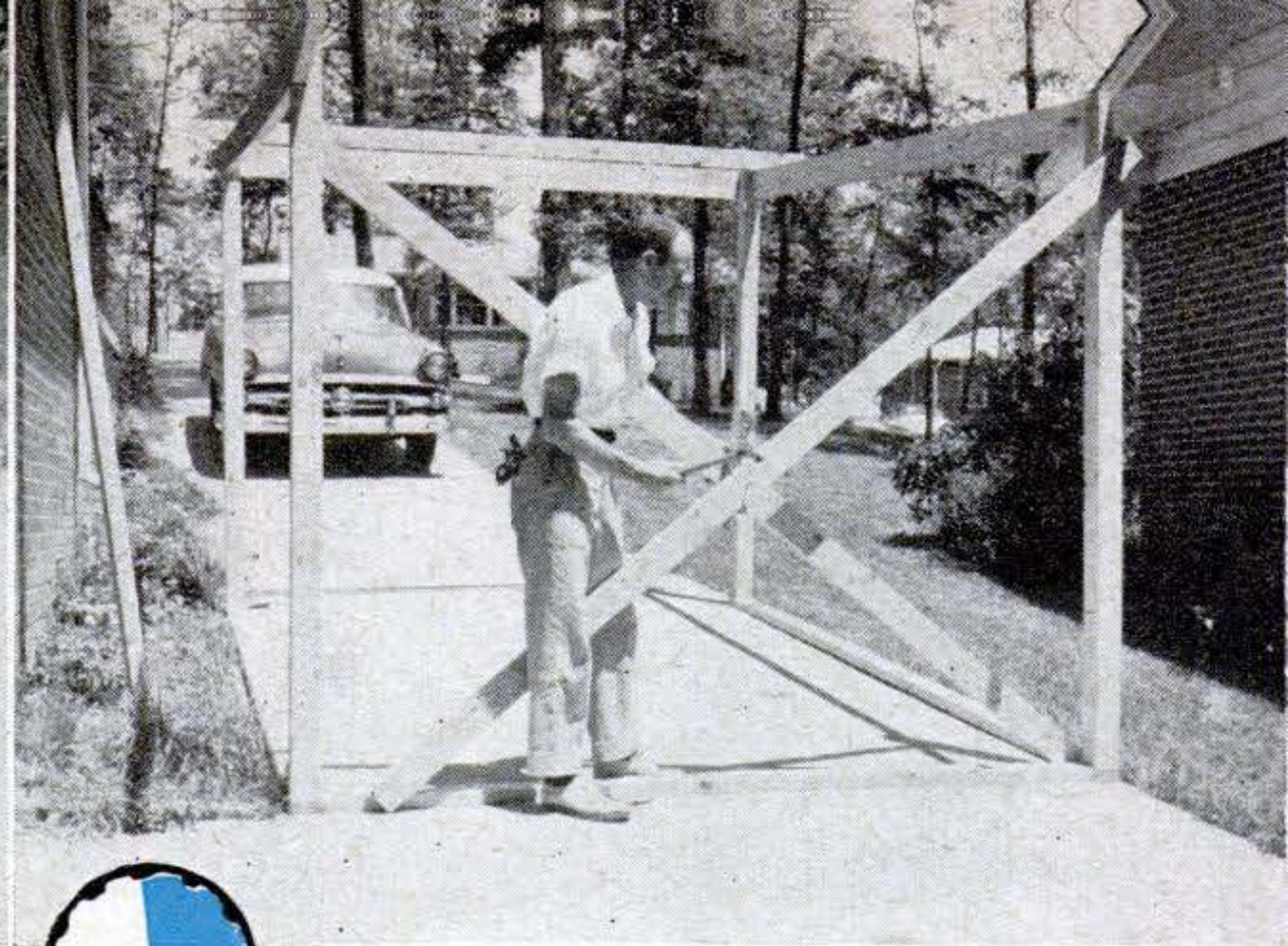
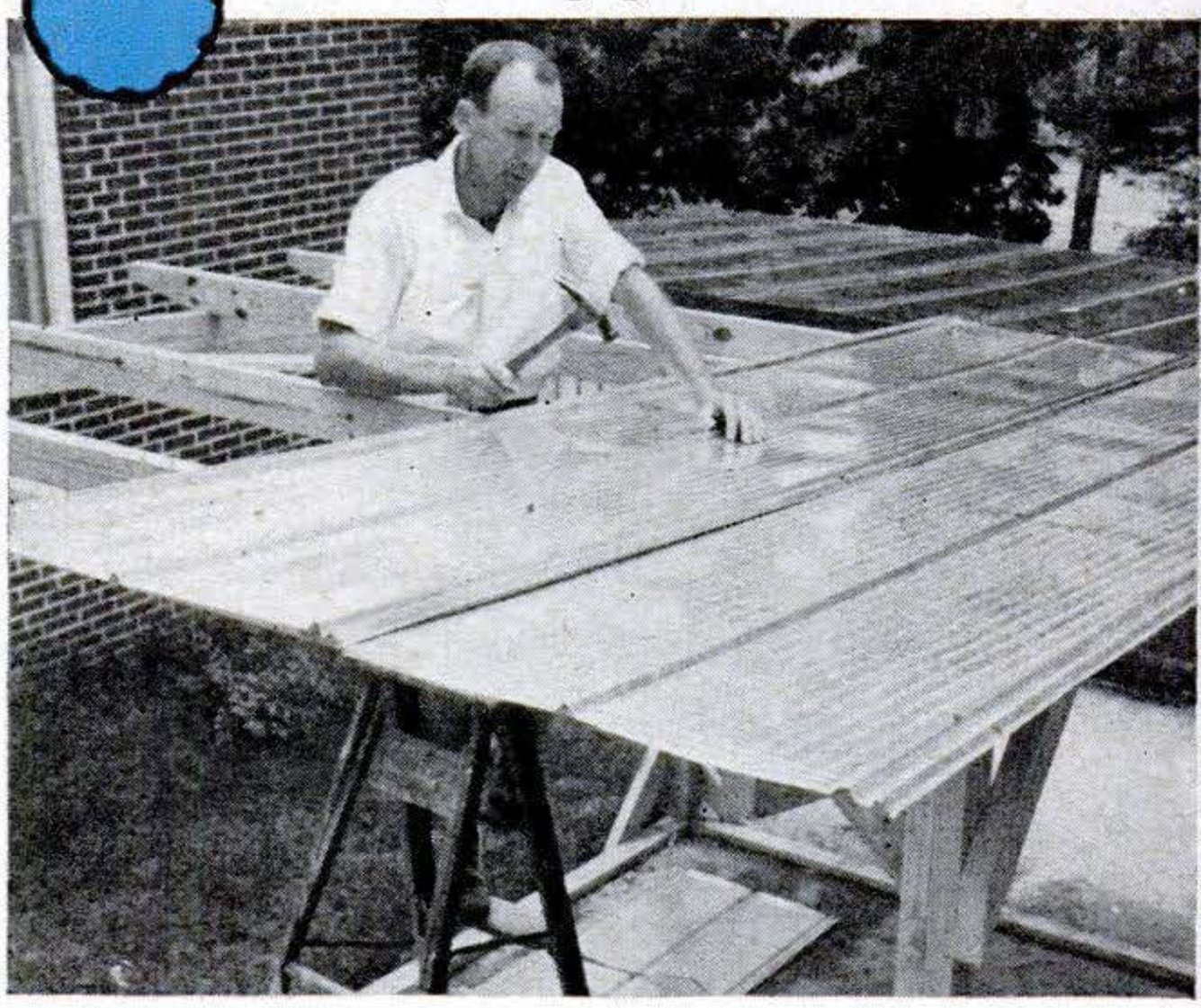
SIDE FRAMES, consisting of plate, corner studs and beam, were nailed together right at the site.



TEMPORARY BRACES at back and header and one rafter at front hold up frames, plumbed vertical.

I Built a Carport in 12 Hours

ROOFING went on fast, first the five pieces at rear and then those at front, using galvanized nails.



THERE'S no need to let that handsome new hunk of sheet metal stand out in the broiling sun—or in the frozen sleet to come—if you allot about $35 and one good day's work to remedying the situation. It's an easy, rather pleasant job, and even if you dawdle disgracefully, it'll be done in a weekend.

I cut the plates, studs and rafters to shape, laid out each side flat on the driveway, and nailed it together with 16-penny common nails. After making another side frame, I raised the two (borrowing a neighbor's hands helps here), nailed the rear cross plate in place, and put on temporary braces.

After the frame was plumbed with a level, I added the two-by-six headers and the corner braces. Bigger braces might be desirable if the site is exposed to high winds, but may involve you in a head-conking hazard. Next came the rafters, which were placed on 36″ centers, with the exception of the fourth rafter from the front. This one was spotted where it was most useful in backing up the overlap of the sheet-metal roof.

I used V-crimp galvanized roofing, and needed five sheets of 24″ by 10′, and five of 24″ by 8′. This gave me a 9″ extension beyond the framing at each end and a 3″ overlap at the center. The floor plates were secured to the concrete by lag bolts run into star-drilled holes. A fast coat of paint on the exposed wood finished the job.—*John Rogers, Decatur, Ga.*

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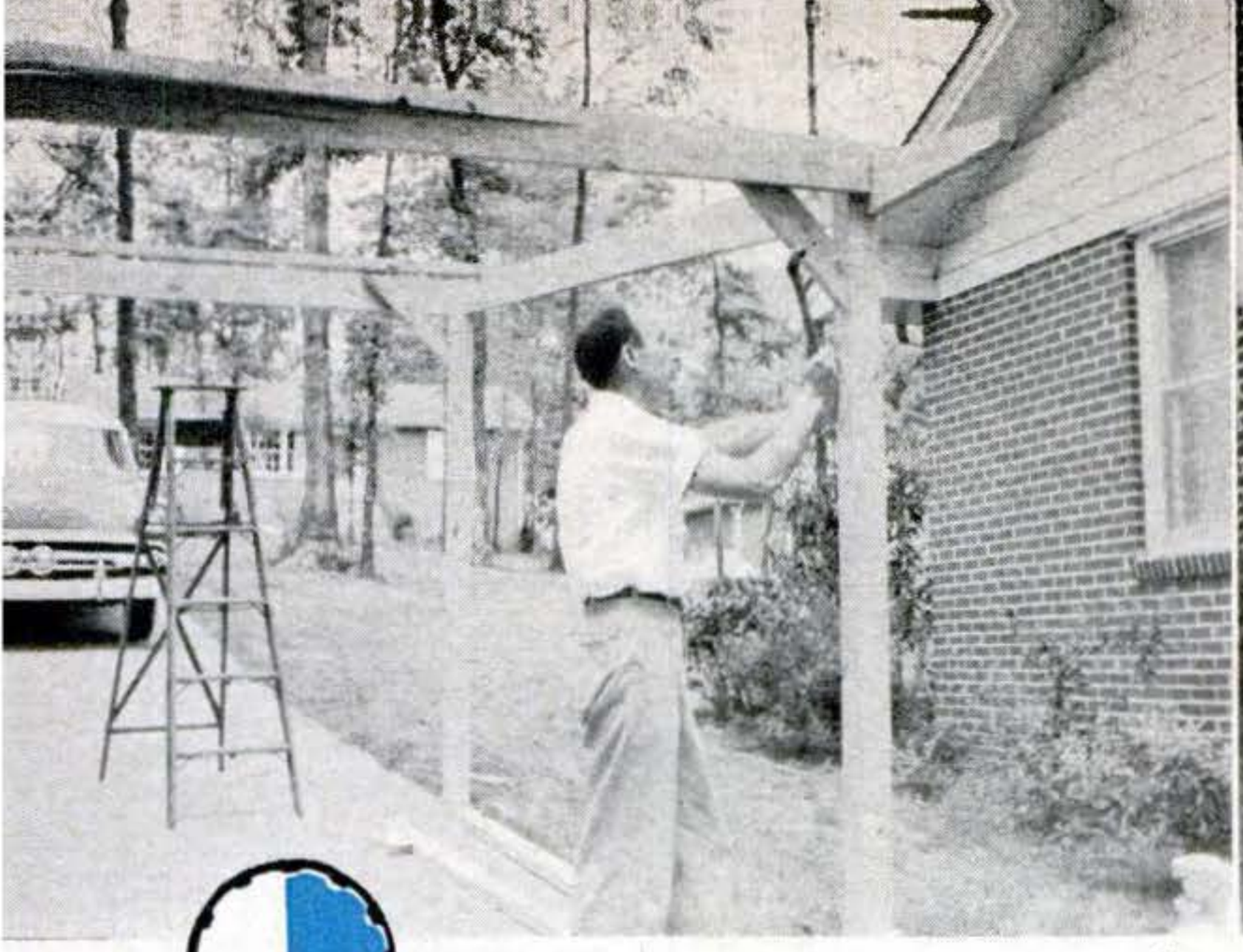
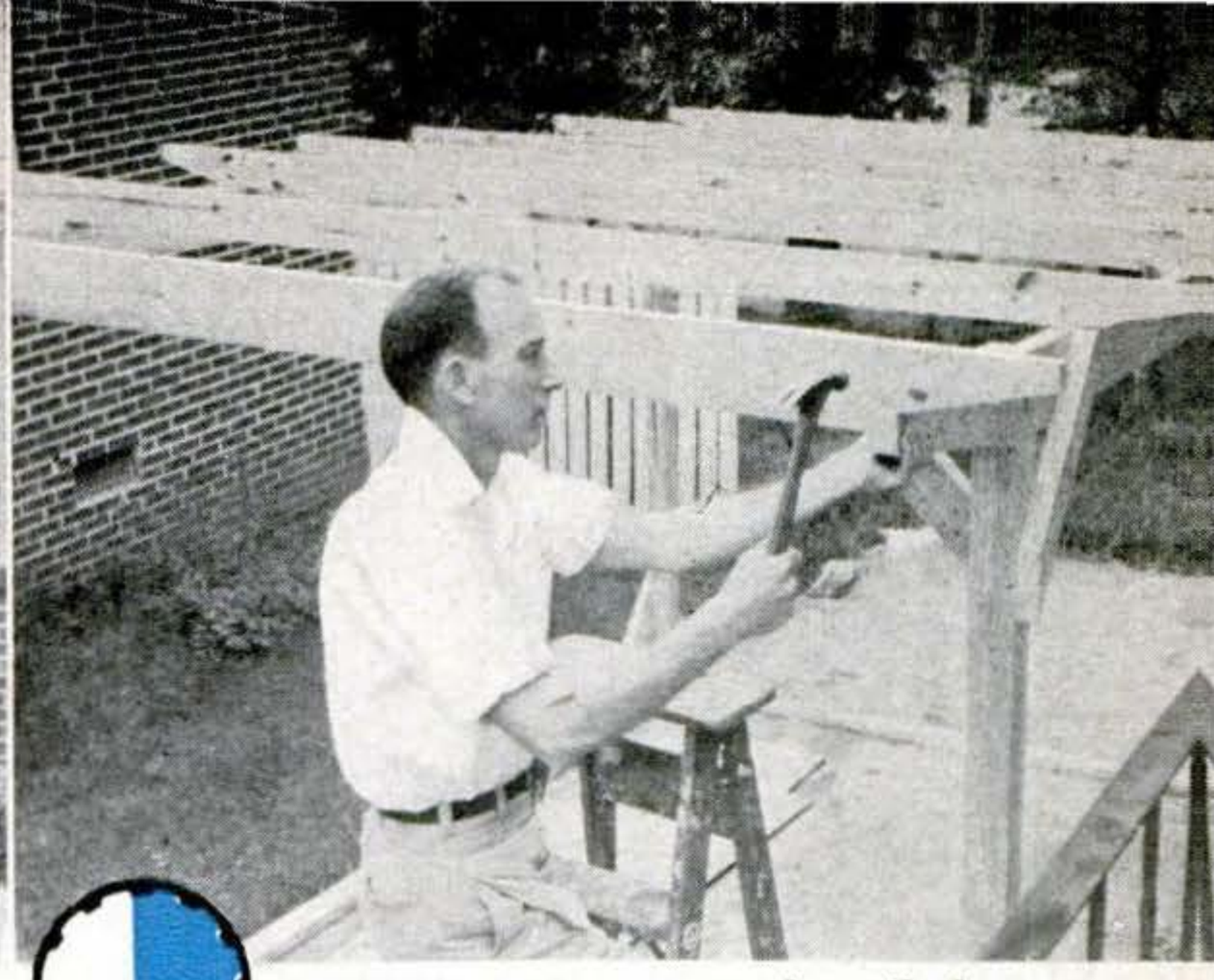
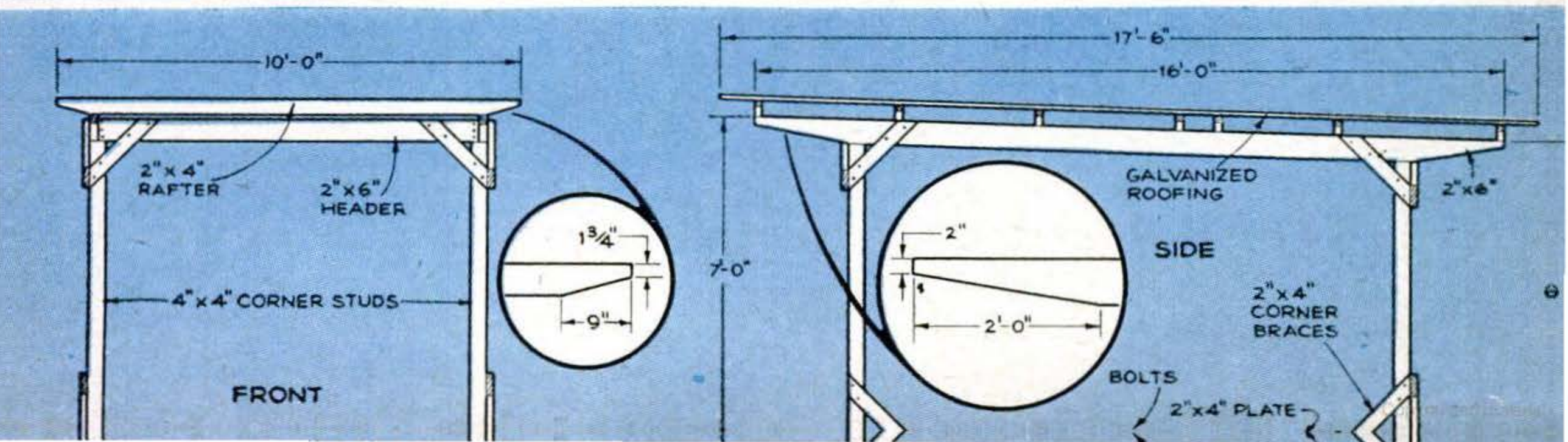


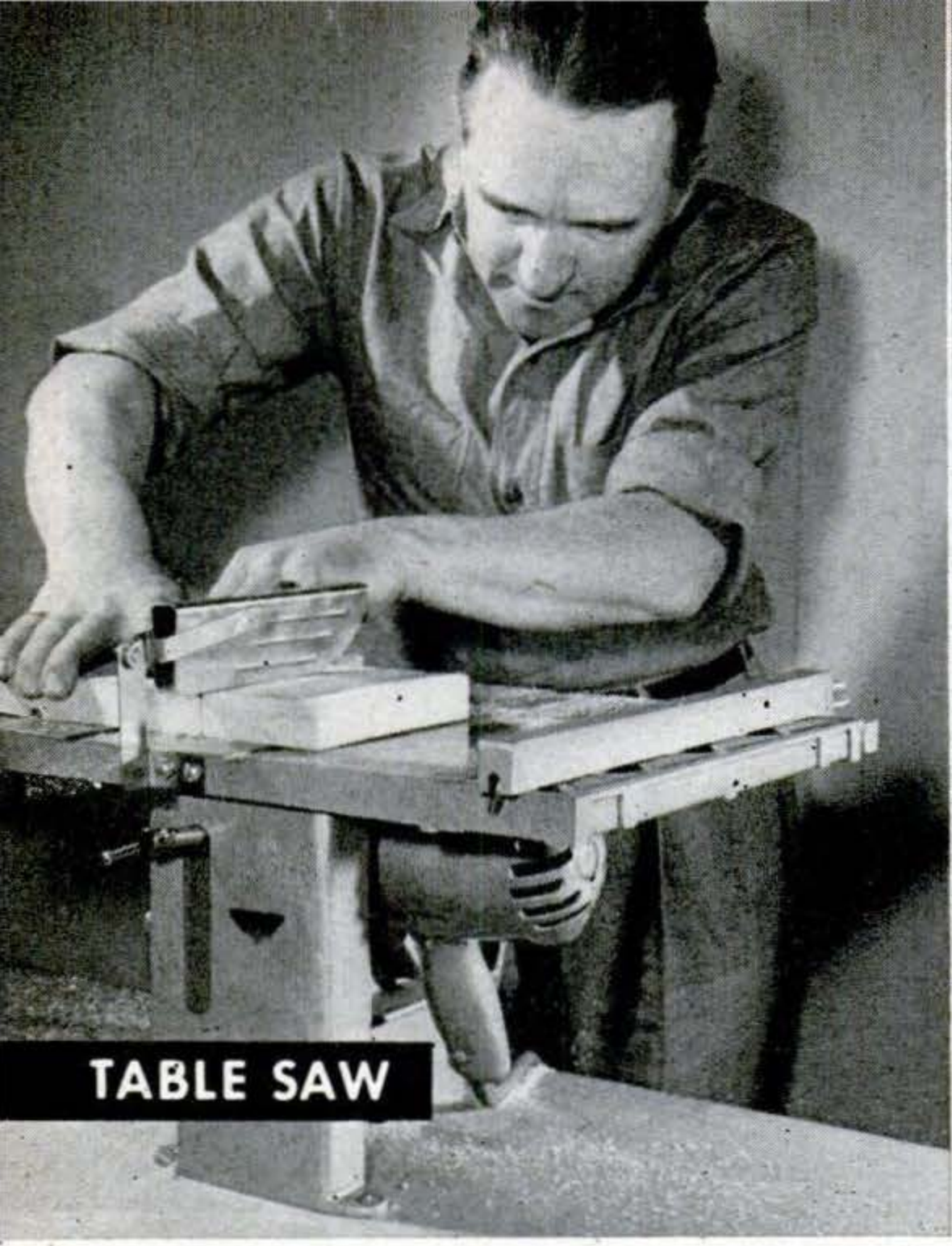
PERMANENT BRACES, two at each corner, were cut and nailed on. Framing is No. 2 yellow pine.



RAFTERS were cut and nailed on next. The one in the middle was spaced to back up roofing lap.

COAT OF PAINT on exposed wood completed the job. Diagonal board under the rafters stiffens structure but isn't essential. But the three plates must be securely lag-bolted to concrete to protect the carport from high winds.





GENEROUS WORKING SURFACE is provided by extensions on each side of saw table. Blade adjusts for depth of cut but does not tilt. Rip fence and miter gauge are included; guard and splitter are extra.

CHANGING IS QUICK AND EASY. Spindle housing (arrow) on power unit is machined to fit split boss in tool casting. Tightening one screw locks unit securely in place. Blade is mounted directly on spindle.

MOUNT TOOLS ON WORKBENCH in seconds with quick-locking bench stand. Tapered stud (arrow) screws into side of unit and draws it tight against stand as T-handled screw is tightened against taper.

Husky Drill Drives Quick-Change Tools

COMPLETE SHOP ON ONE BENCH. Power unit is being attached to portable saw (below) while other tools stand by ready for action. Grinding attachment (on bench at right below) has housed wheel and adjustable tool rest.

This versatile outfit bridges

BY PURCHASING all these rugged workshop attachments in one package, you can quickly fit out a home shop at reasonable cost. Or, they may be bought as needed, starting with the basic power unit, which includes a ⅜″ capacity Jacobs drill chuck, polishing bonnet, sanding disks and back-up pad, spindle arbor for buffing or grinding wheels, and an extra handle for use on either side of the drill.

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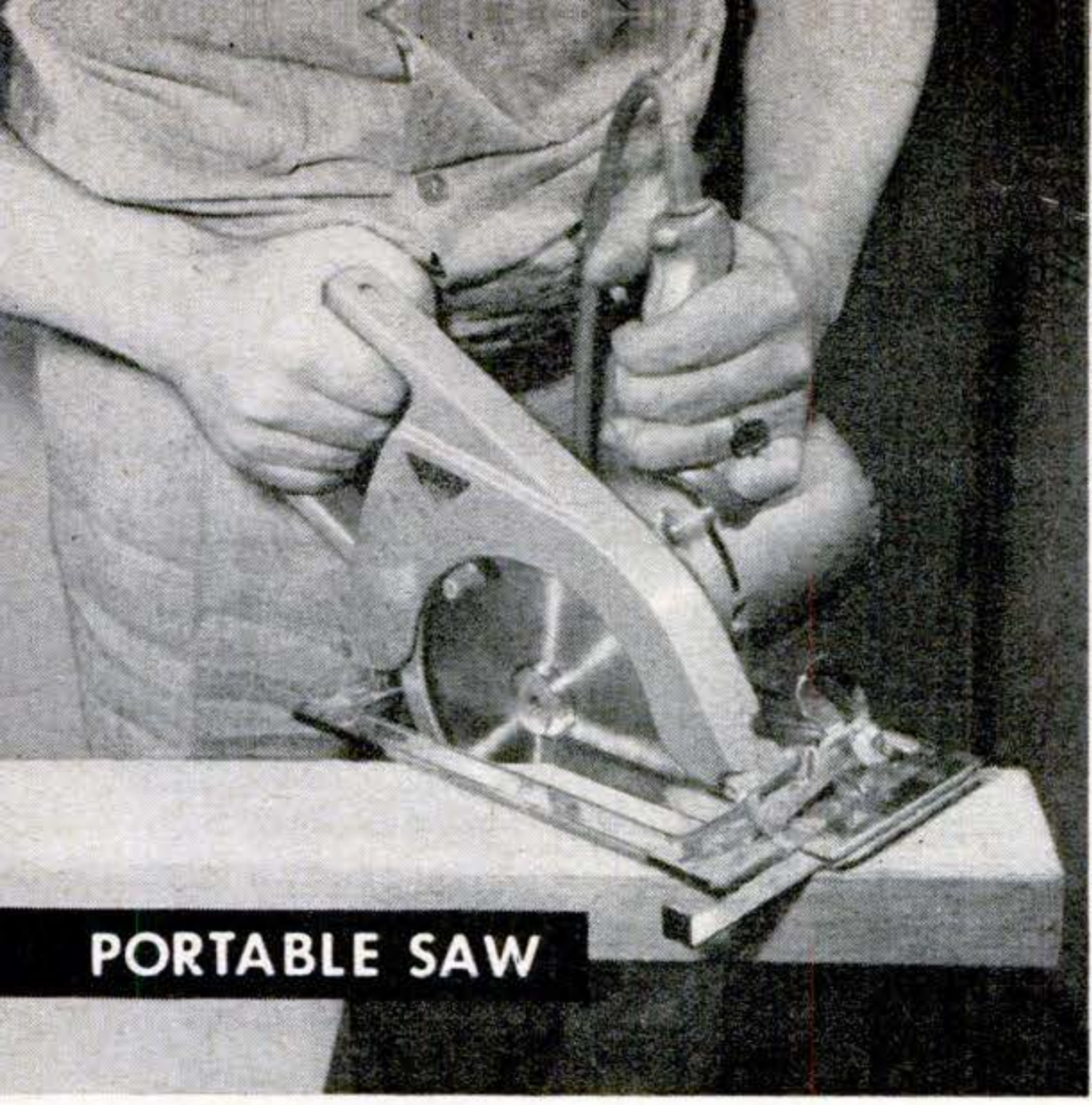
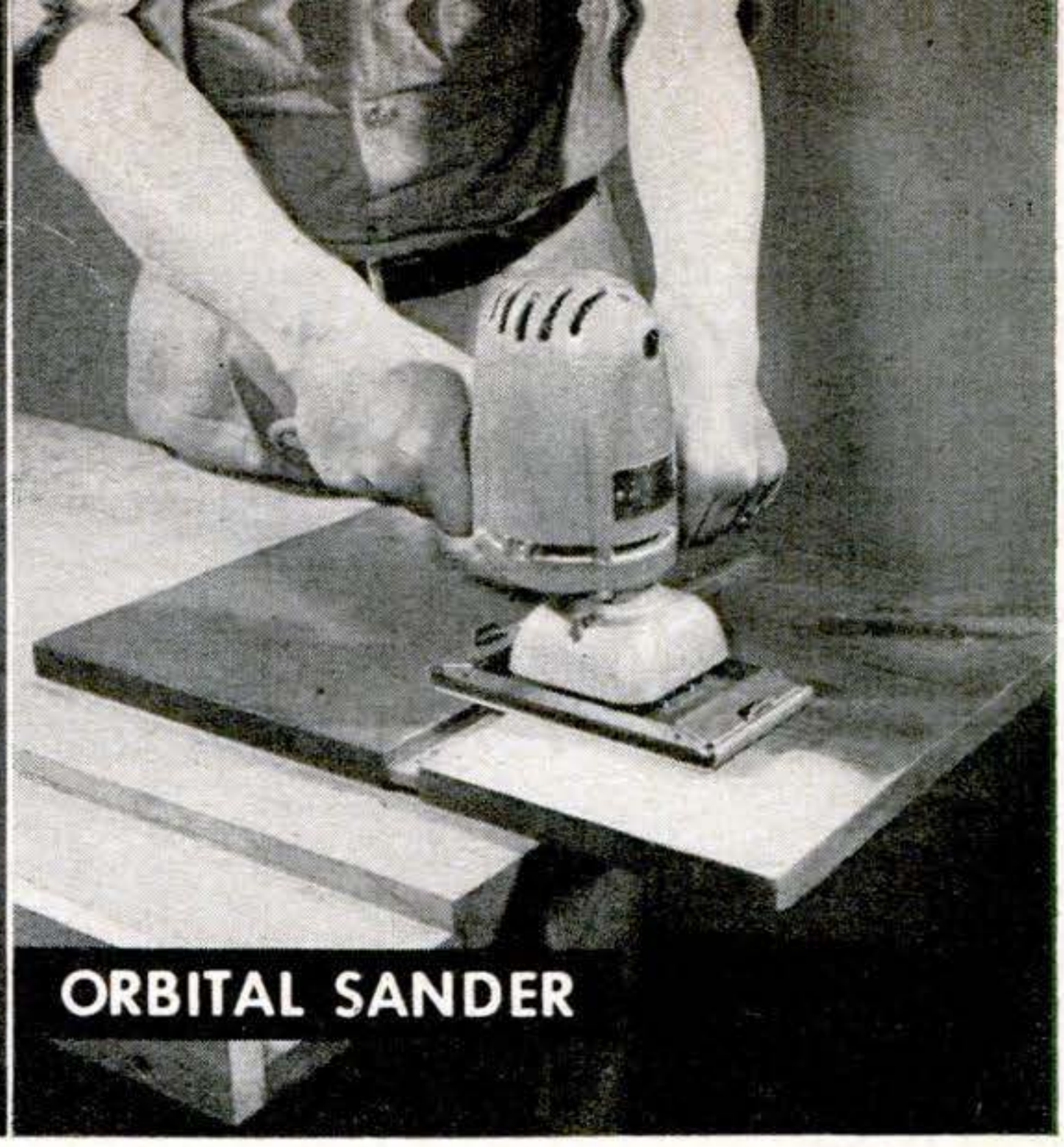


PORTABLE SAW



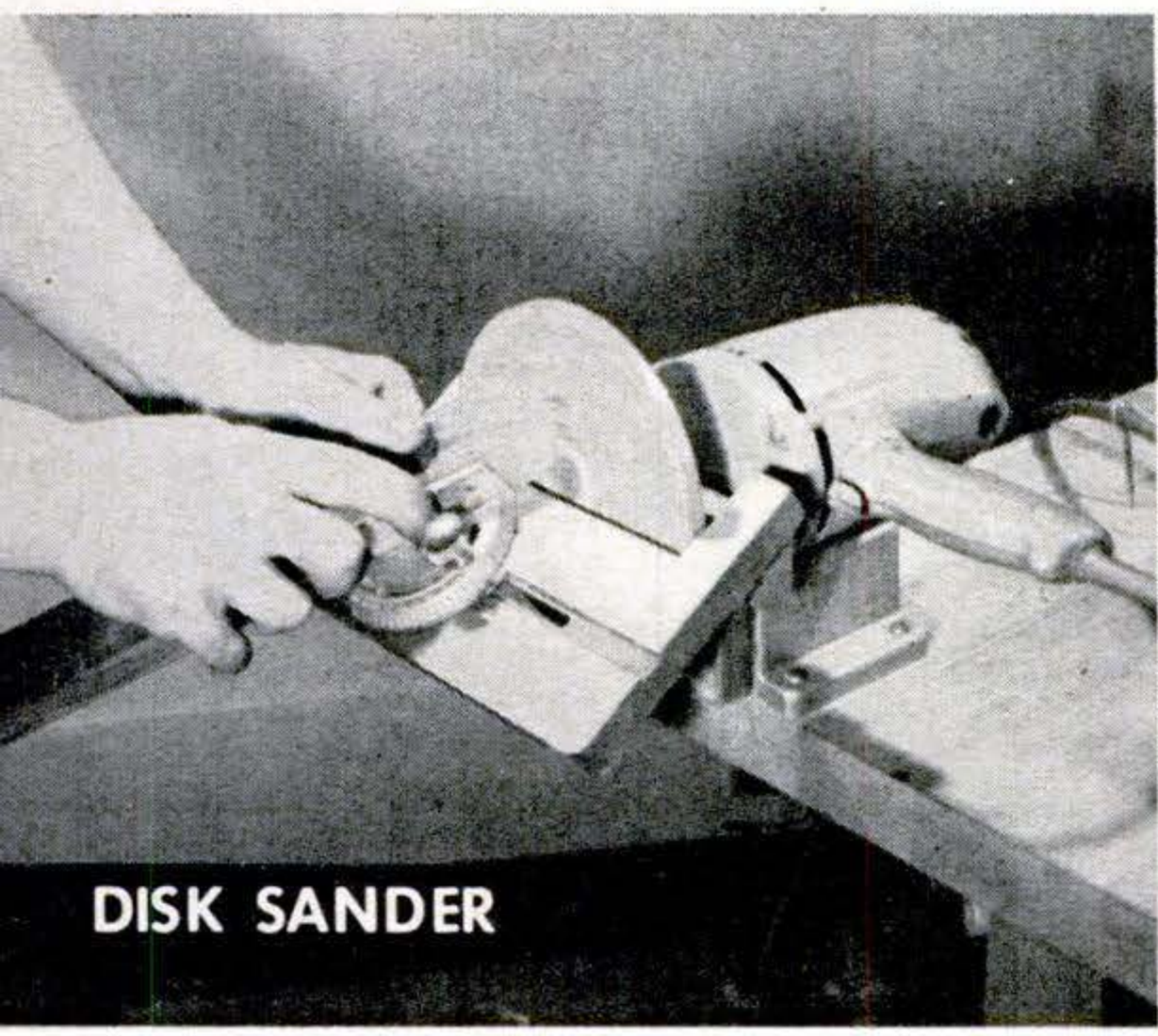
ORBITAL SANDER

DRIVEN AT 3,200 R.P.M. by power unit, well-balanced portable saw cuts to 1 7/8″ depth—deep enough to handle joists, rafters and all other lumber used in home construction. It uses same 6″ blade as table saw.

ONE-THIRD OF STANDARD SHEET OF SANDPAPER is held on rubber-backed sanding shoe by two spring clips. Mechanism is counterbalanced, reducing vibration to minimum. Sander produces smooth finish on wood or metal.

TILT TABLE and adjustable angle gauge permit sanding compound angles. Sandpaper is applied to 6″ disk with adhesive. Table is attached to bench stand by two screws shown in photo at left. Disk screws on spindle.

SHOWN HERE WITH TABLE for bench use, jigsaw can also be used without table as portable jigsaw for cutting into large panels of wood or sheet metal. When hand-held, it starts its own cut, eliminating drilling of starting hole.



DISK SANDER

JIGSAW

the gap between light attachments and heavy combination tools.

The heart and muscle of the attachments is a heavy-duty ⅓-horsepower unit rated at 4.0 amps. It is not just an electric drill that can be used with attachments, but rather, a compact power plant, *made to drive* the attachments, and supplying more than enough power for the many operations that can be performed with them. Its speed, 3,200 r.p.m., is faster than most electric drills, making sawing and sanding easier and faster. You can buy an extra power unit without chuck or accessories for economical permanent installation in one of the most-used attachments, such as the portable saw or table saw. Tightening one screw locks the unit to any attachment or to the bench stand without fussing. Called the 888 power unit, it will be in hardware stores in September. Millers Falls Company, Greenfield, Mass., makes it. END

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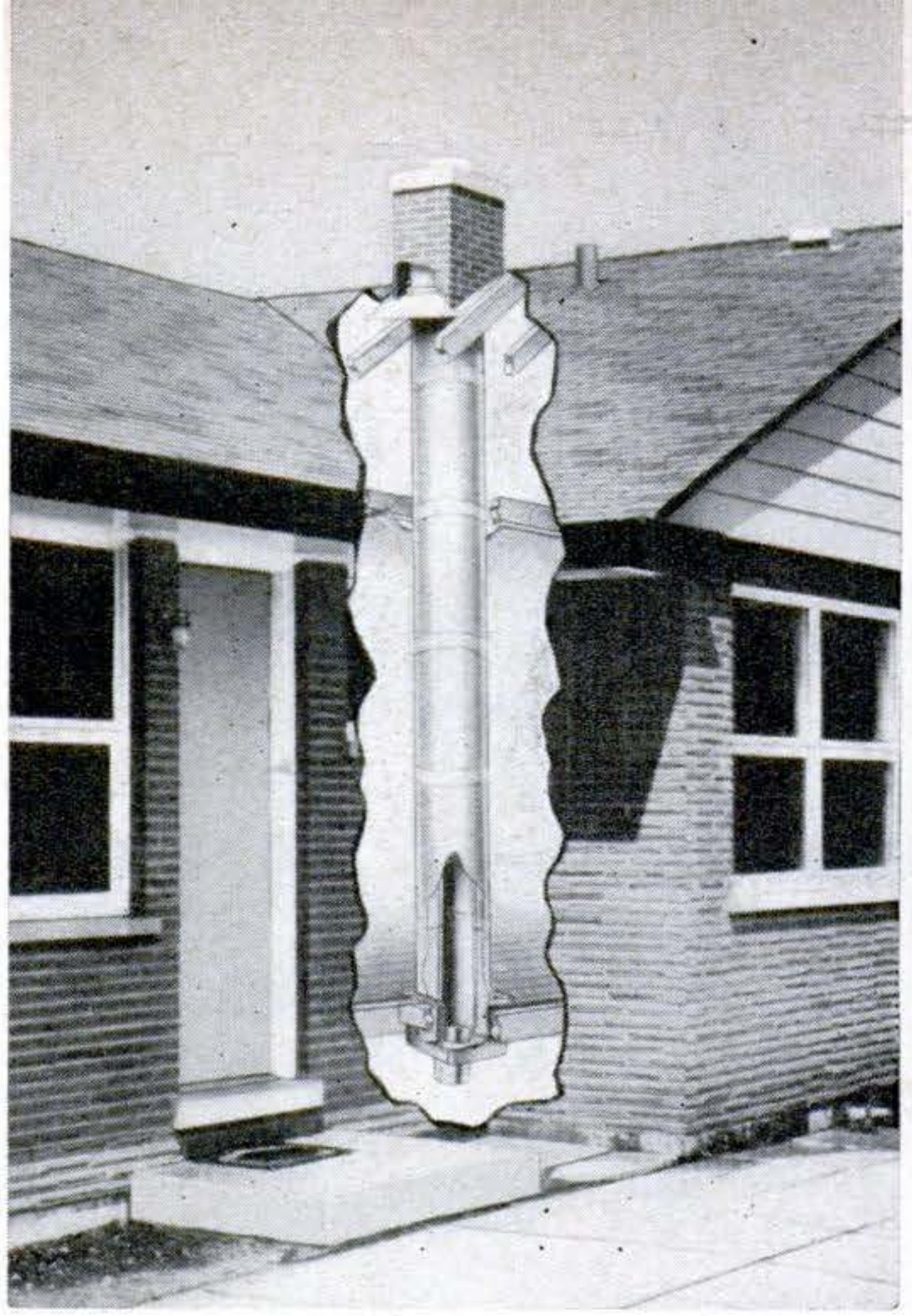
Kit Makes It Easy to Build a Chimney

No need to be a mason. Just put together the prefab sections.

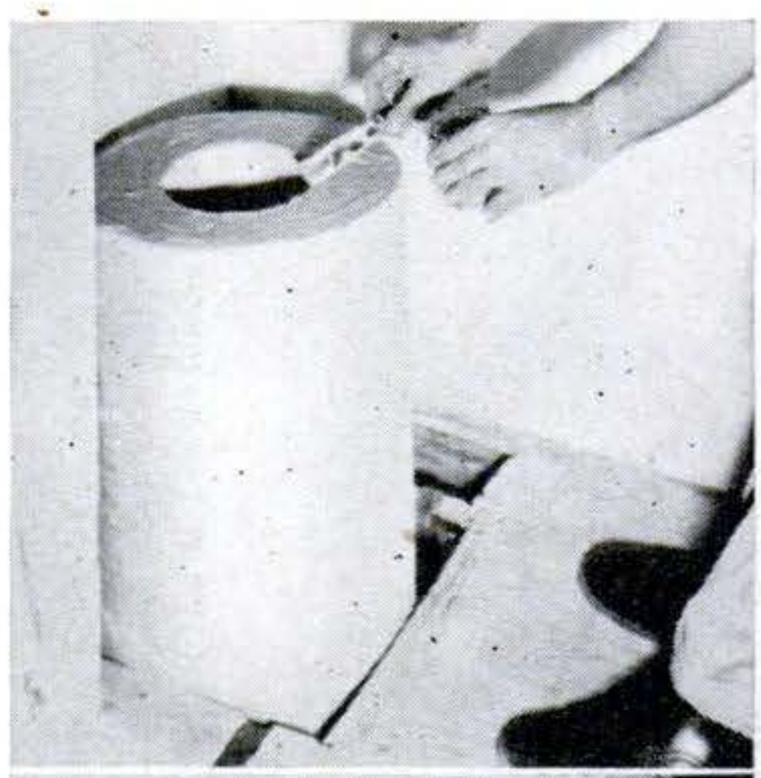
YOU might think building a chimney is a job for an expert mason. Well, here is a kit chimney that can be put up in three hours. Four textured panels mounted around the roof flue give the appearance of brick. The panels are 3/16" cement-asbestos that can be painted to match any color. They are available in various heights. To top it off, a rain cap that comes with the kit keeps rain from entering the flue. Installation of the flue sections is about as easy as stacking blocks. Thermal-setting cement takes care of the hard work.

The Van-Packer Corp., 209 South LaSalle St., Chicago, makes the kit.



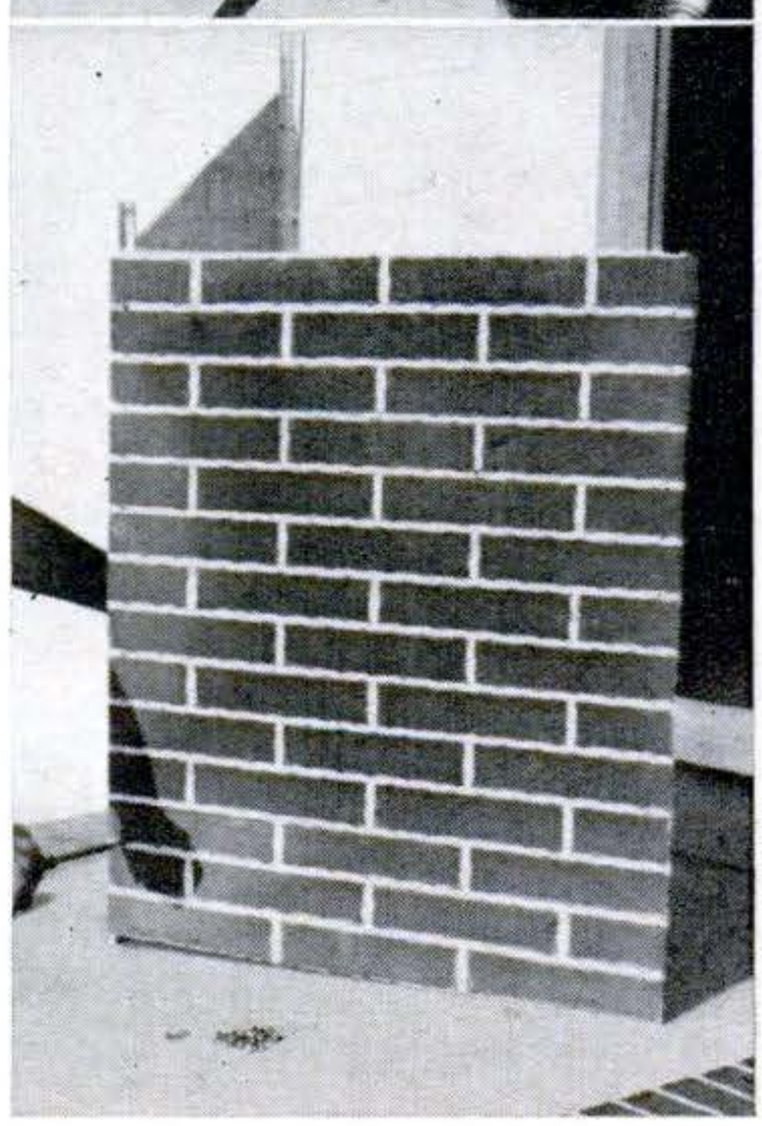
CHIMNEY is suitable for use with heating plant or incinerator. Manufacturer does not recommend use with a fireplace—the opening is too large to be readily adapted.

CHIMNEY SUPPORT is seated in floor opening cut between joists. All sides of the support are nailed to framed opening between the joists.



FLUE JOINTS are cemented and secured with an aluminum drawband. Clearance from flue to wood is unnecessary because of insulating capacity of masonry sections.

ALUMINUM FLASHING is installed on roof around the base of the flue to keep moisture from seeping in. The roof and ceiling openings were projected with a plumb line from the floor to permit passage of the flue sections.



"BRICK" PANEL housing, 16" by 24", for the chimney is assembled on the ground. Before putting it over the flue, the proper pitch of the roof is determined by placing a panel flat on the finished flue. Panels come in lengths up to 5'.

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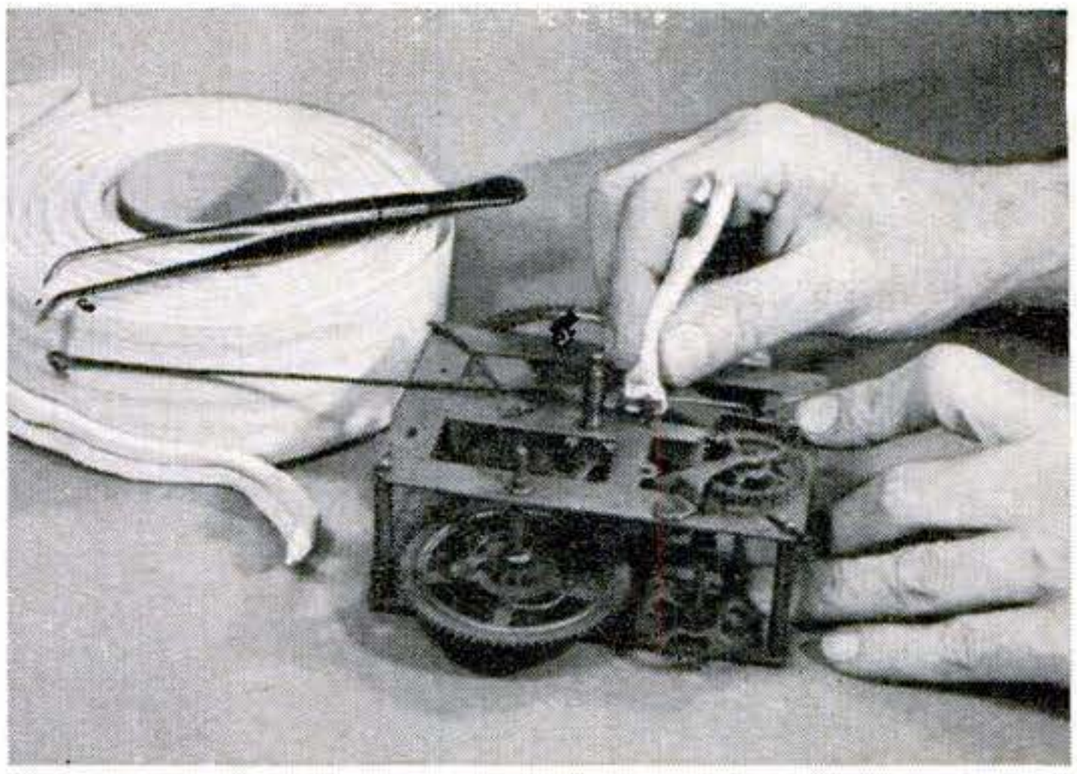
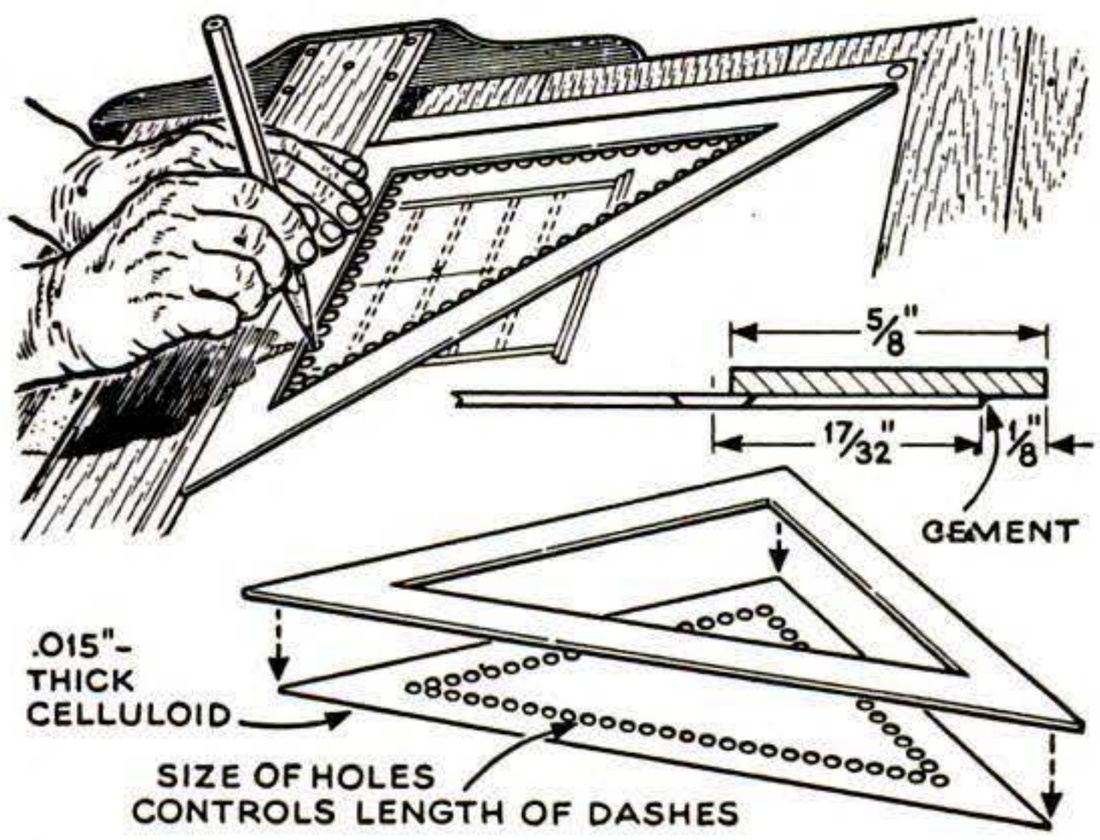


Calk Compound Cleans Clocks

CALKING compound of the cord type, which has a prolonged tackiness, is handy for extracting dirt from clocks, cameras and other mechanisms. Shape a piece so it will reach the material to be removed. After the compound has picked up a quantity of dirt, knead it to expose a fresh surface.—*Walter E. Burton, Akron, Ohio.*



Drawing Dashes Is Easier

WITH this reworked celluloid drafting triangle, drawing dashes becomes almost as simple as drawing a solid line.

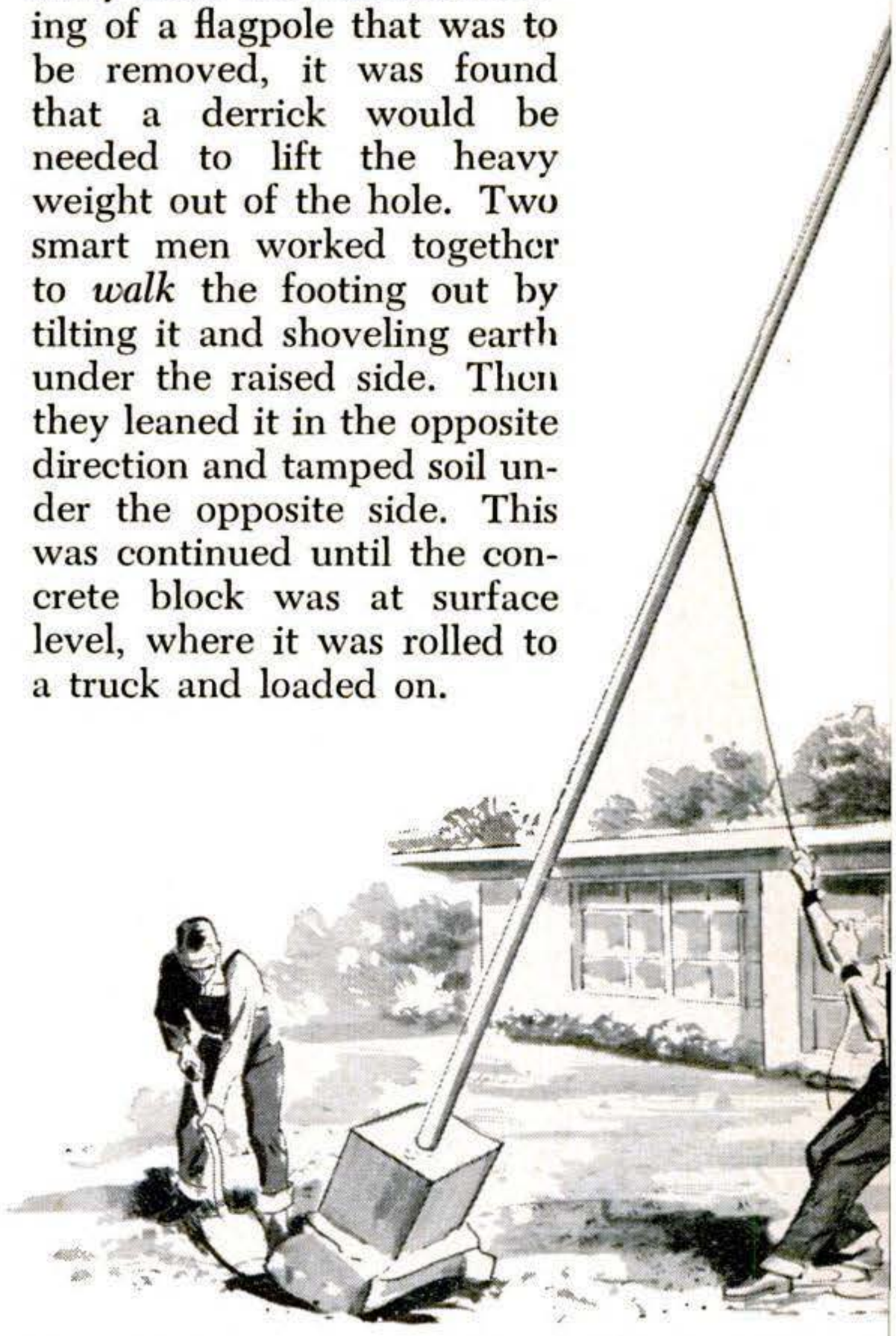
Any triangle can be used. Enlarge the center to leave a strip about ⅝″ wide. To get the inner edge parallel, use a saw and then file accurately to the line.

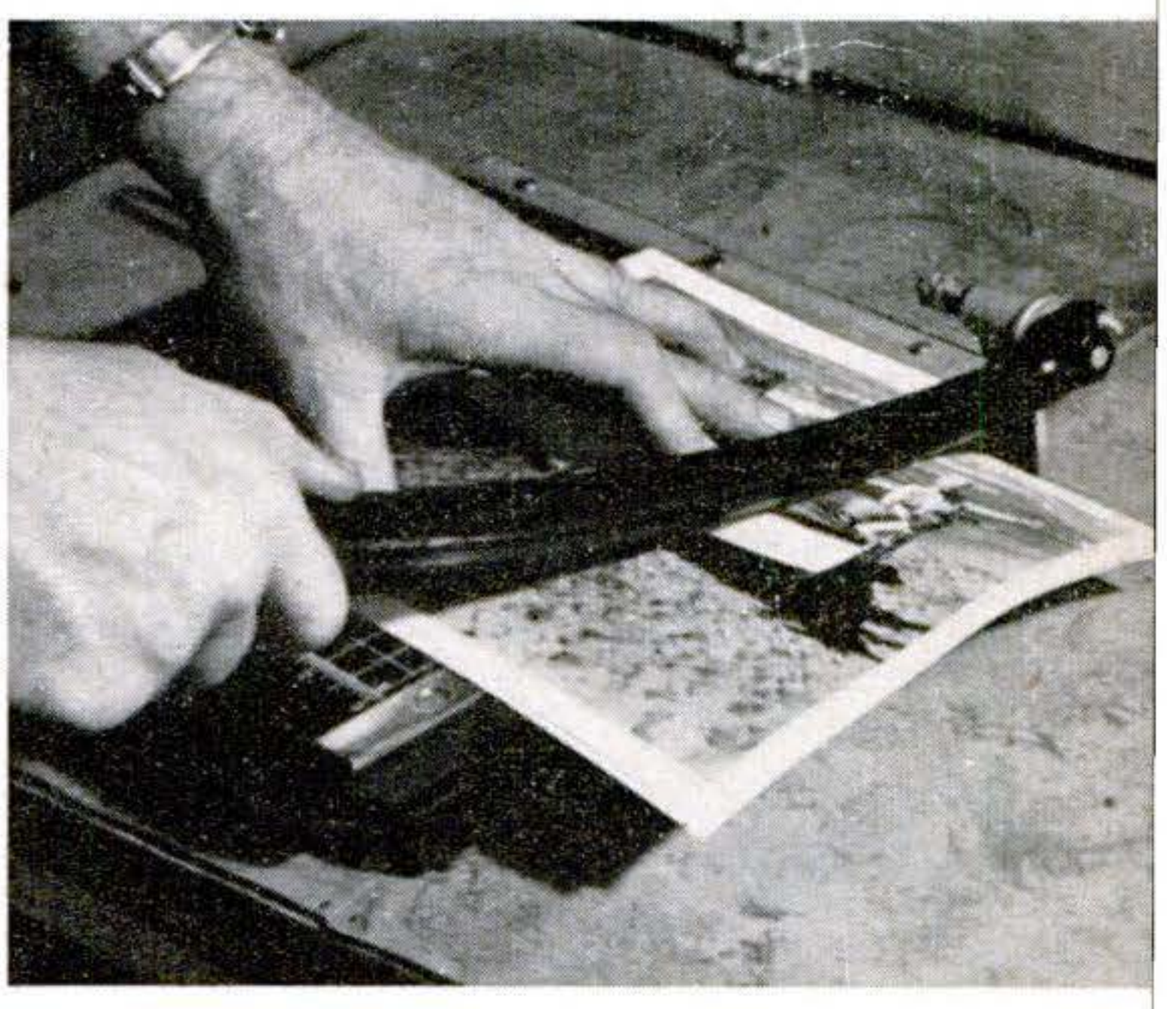
Celluloid, sold in auto stores for convertible windows, is suitable for the inner part. Cut it ⅛″ smaller than the triangle. The recess thus formed will keep ink from seeping under the outer triangle edge.

Lay out the holes with their centers 1/32″ inside the triangle edge. A countersink gives a satisfactory bevel. Make the holes a bit larger than the dash length desired. Attach the parts with film cement.—*E. P. Meyer, Albuquerque, N. M.*

Flagpole Walks Out of Hole

AFTER dirt had been dug away from the concrete footing of a flagpole that was to be removed, it was found that a derrick would be needed to lift the heavy weight out of the hole. Two smart men worked together to *walk* the footing out by tilting it and shoveling earth under the raised side. Then they leaned it in the opposite direction and tamped soil under the opposite side. This was continued until the concrete block was at surface level, where it was rolled to a truck and loaded on.





How I Make Scratch Pads

IF YOU are an amateur photographer, what do you do with the unsatisfactory prints you discard in the darkroom? I cut mine into uniform sizes and use the backs as handy scratch pads on the telephone desk.—*Clinton R. Hull, Costa Mesa, Calif.*

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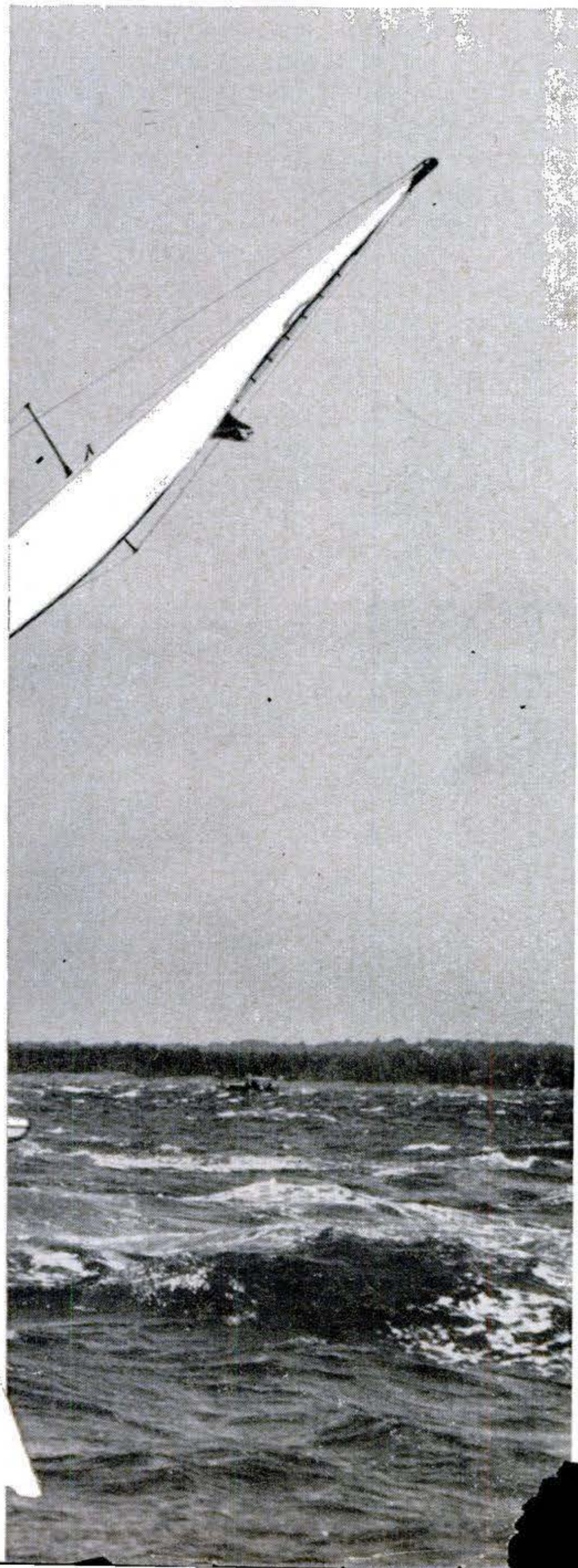
He Shoots Pin-Ups

This ace photographer of boats and boating has gone down to the sea with his camera for better than 50 years. Here he tells how to shoot sea, ships and sky.

at Sea

By Dave Stanley

RACING HYDROPLANE leaps clear of the water. Photo trick here is to anticipate not only the second of the leap but the split second when the boat will be at the peak of its lift.



ONE of the biggest threats to America's peace of mind is a soft-spoken, gray-eyed, 68-year-old salt who lives on an island about 15 miles from New York's Times Square. He disturbs the serenity of factories, offices and homes from coast to coast by inspiring millions to daydream. This menace is Morris Rosenfeld, America's No. 1 boat photographer.

For half a century, he has been clicking his shutter at stately windjammers, sleek ocean-going sloops, Snipes, bugeyes and prams. In magazines, government films, travelogues, ads—even as huge murals in famous sea-food restaurants—these eye-filling photographs of boats heeling gracefully before the wind have stirred the national wanderlust.

Although Rosenfeld runs a thriving photographic studio, his mainstay and first love is taking pictures of boats. And his marine-camera wizardry has paid off handsomely. Prints of his famous nautical pictures hang in yacht clubs and homes of boatowners from Maine to the Persian Gulf.

Steady Hands and Stout Sea Legs

If you're Morris Rosenfeld, you generally shoot from your own motorboat, the *Foto*, a 23-knot studio-darkroom. You shoot from a deck that bucks like an unbroken mustang, holding your camera steady with both hands and balancing yourself only with your sea legs. You will chase a

RACING SLOOPS tack on the windward leg. You have to know racing tactics, as Morris Rosenfeld does, to be in the right place at the right time to get dramatic shots like this.

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STARTLING SPRAY PATTERN made by this sport fisherman is a Rosenfeld trick, not often used. Boat is following in wake of the *Foto*. Nature furnished the nice clouds, he adds.

GOING GETS ROUGH sometimes—and tough for the photographer who is using both hands to hold his camera. Rosy's camera case almost slid into the sea while he took this.

craft for hours, while keeping out of the way of other boats in a championship race, to frame your target in the best relationship to sea and sky.

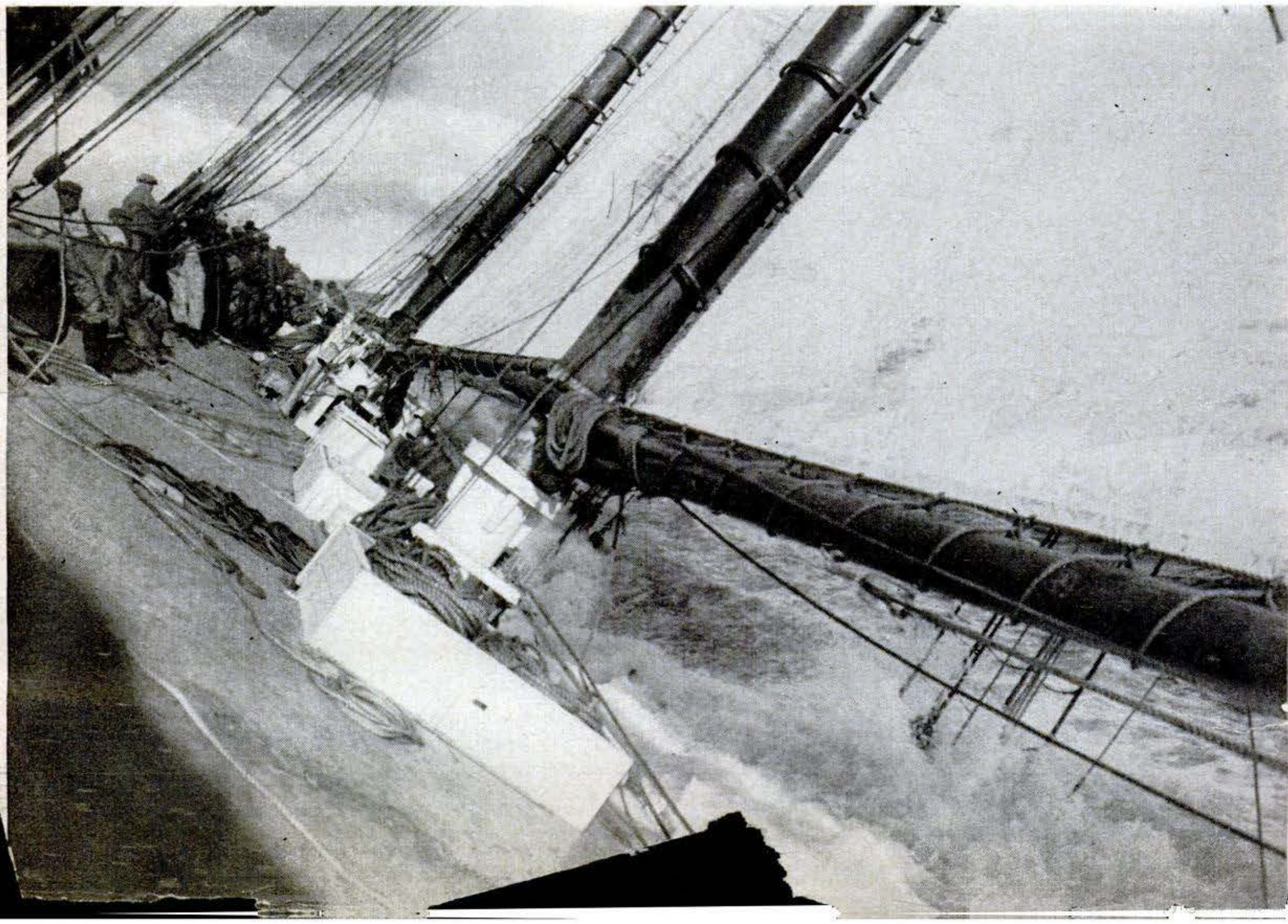
Sitting in his spacious New York studio, Rosenfeld told me that the key to marine photography is "knowing what to say." Knowing what to say, however, presumes a keen knowledge of boating, as well as cameras, film and filters.

Sea Savvy Wins Him Rare Shots

His nautical savvy, for example, tips him off when a new tack is to be taken. Alertness to what strong winds can do has brought him rare shots of masts snapping off or boats heeling completely over.

Rosenfeld is also a first-rate mechanic. Not long ago the *Foto* was stalled off Long Island. Heavy winds threatened to hurl it against jagged reefs. Rosenfeld quickly traced the trouble to the carburetor, took it apart, repaired it and reassembled it. Before long the *Foto* was chugging safely away from the reef.

The sky and the water always fascinated Rosenfeld, who bought his first camera, a 4-by-5 Graphic, back in 1896. Actually, the poor East Side kid didn't buy it himself; he went "halfies" with some grade-school chums. When his day for the camera came,



he would walk along New York's waterfront, then swarming with sailing vessels. The giant 10-story-high windjammers from the ports of the world, their canvas spread out, thrilled the youngster. One day he set up a tripod and shot a ship silhouetted against a sunrise. It won a $5 prize, parental approval and a year's subscription to an early photo magazine.

After working during several summers for a commercial photographer, Morris Rosenfeld became one of the country's first press photographers. As photoengraving was in its infancy, Rosenfeld's photographs were often used by artists as a basis for drawing news illustrations. During his newspaper career he set up his tripod at some of the top news breaks of the time: the Russo-Japanese peace conference, Admiral Dewey's parade, the great Baltimore fire. Once Rosenfeld rushed to an editor with a colossal idea—to shoot the Wright brothers as they attempted to fly at Kitty Hawk.

"Rosy, you're absolutely crazy," the editor scoffed. Rosy didn't get his scoop.

FLYING SPINNAKERS, a Rosenfeld masterpiece, is probably the best-known boat photograph ever made. It was snapped in 20 minutes, has paid him handsomely in royalties.

Boating Is Big Business

Along with general news, Morris Rosenfeld always kept close to his boyhood love—boats. From 1898 on, he shot the Lipton International Cup Races, as well as thousands of other minor regattas. In 1920 he dropped general news free lancing, and shot boats exclusively. Today he is riding the crest of a boating boom. What used to be a sport of the leisured few is now a major recreation. It takes in Texas cowboys, Minnesota machinists, New York accountants, housewives in Arizona. Pleasure boating is a fabulous 600-million-dollar annual business (5,000,000 boat owners—yachts to peanut-size prams).

And riding the crest with him are two of his sons, Stanley and William, who also are photographers. (A third son, David, teaches photography in a New York vocational high school.)

"It's easy to see why boating is becoming more popular," says Rosenfeld. "It's a sport the whole family can enjoy together, there are less-expensive boats available today, and there's lots more room on the water than along crowded highways."

These new boating enthusiasts now go down to the sea with cameras as well as box lunches. For them, Rosenfeld offers a few photographic tips:

- On shooting action: "To get boats in speed racing, you have to shoot fast enough so that the picture is not blurred, but not so fast as to freeze all action, making sea spray, for instance, appear as a mass of individual droplets."
- On lighting: "You have to keep your eyes peeled for variations of effects. It is 360 degrees around the horizon, so place the boat in a part of the sky where you can use the direction of the light either to silhouette the subject or for modeling to bring out shape and form, such as billowing sails."
- On lens care: "If you're shooting from a fast-moving boat and the lens gets wet with salty water, rub it gently with lens tissue; otherwise the salty particles will scratch the lens."
- On filters: "Use medium-yellow ones. They give you the sky tones and will accentuate the clouds. They also protect the lens against salty spray."
- On shooting within a boat: "Expressions are significant. The hands, bodies and gestures of the people aboard are important. The smaller the boat, the more significant the little actions and gestures. And the best shots are not always the violent ones. A baby sleeping or someone resting in the sun can be equally effective." END

Copyrighted material

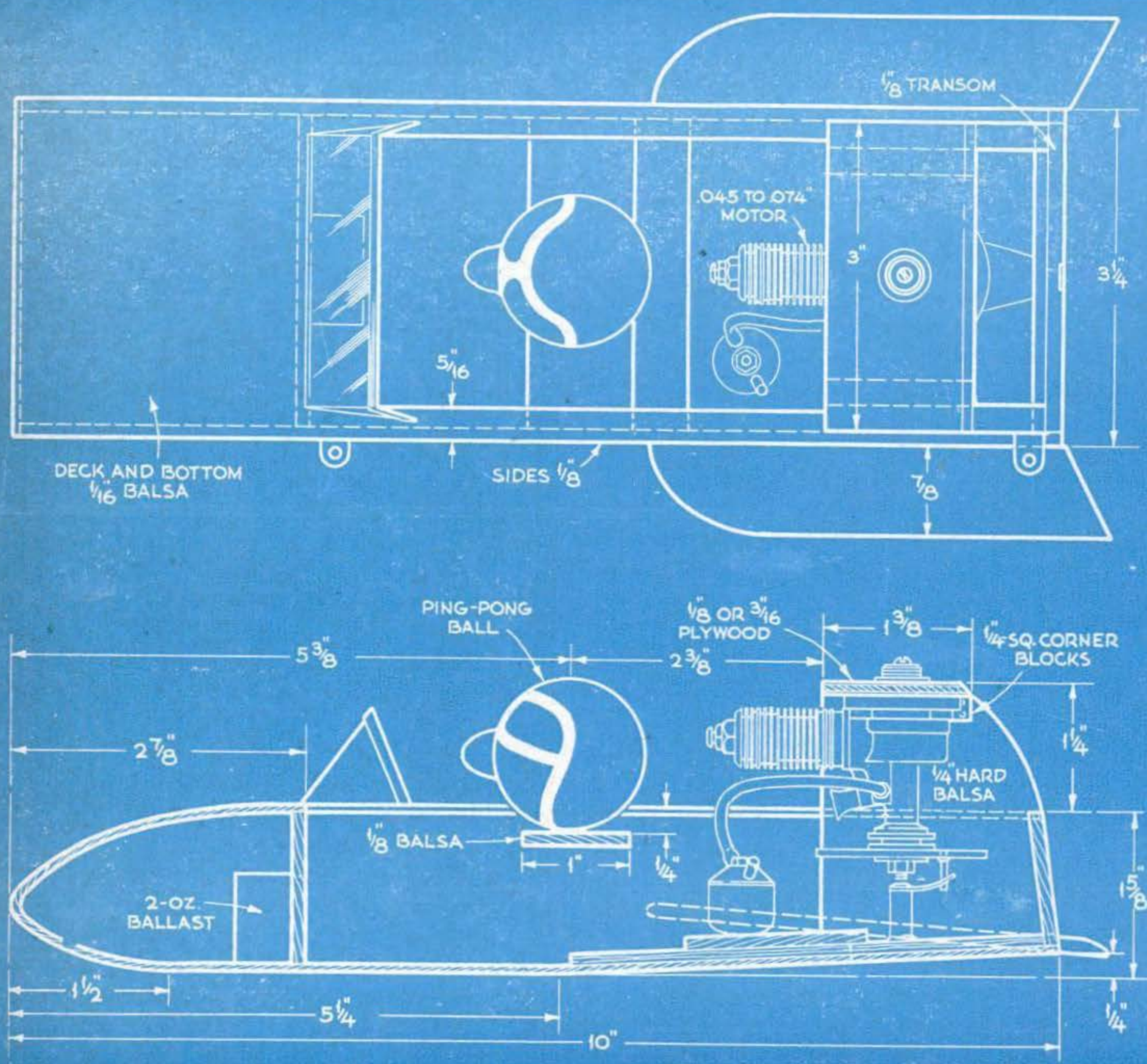
Hydrojet Powers Little

Newest thing in nautical propulsion, this clever midget boat has no weed-snagging paddles or prop—won't nip unwary fingers.

By Roy Clough

HERE'S a little boat that skims over the water like a speedy sea sled, riding high on two rocket-like chine planes. Yet when you pick it up you'll find no finger-nipping propeller underneath. The only clue to its hidden power is the intake port on the bottom, and an exhaust port directly behind it at the stern. Housed in a casing between them is a rotary pump which draws in water and kicks it backward at high speed. Reaction to this stream drives the boat.

The hull. Use ⅛" sheet balsa for the sides, bulkhead, transom (stern), pilot's-head support and chine planes. Thinner balsa serves for the bottom, deck and gunwales. Before decking in the bow be sure to



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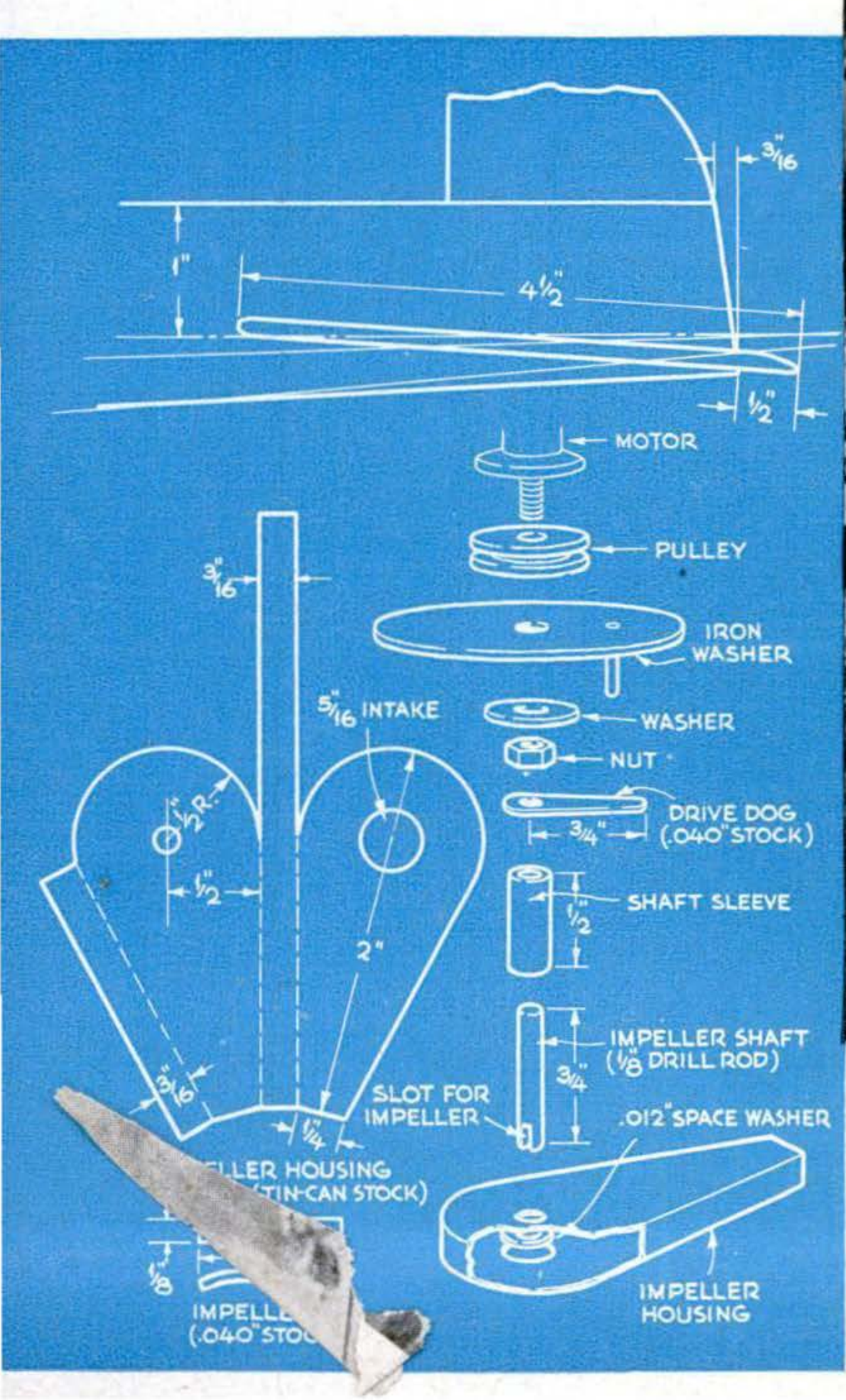
Speedster

cement a couple of ounces of ballast to the front of the bulkhead. A ping-pong ball forms the pilot's head, and the windshield is a scrap of acetate sheeting edged with tin. To finish off the hull, sand down the assembly and cover it with model tissue, then paint with hot-fuel-proof dope.

Pump and housing. Before building an engine mount, the driving unit should be



OFF TO A FLYING START, the hydrojet speedster is already climbing. Top and side elevations on opposite page are half size for a boat powered by an .047 displacement engine. The upper detail drawing at left indicates the planing angle; the exploded section below it, the pump-housing pattern and impeller-and-shaft assembly.

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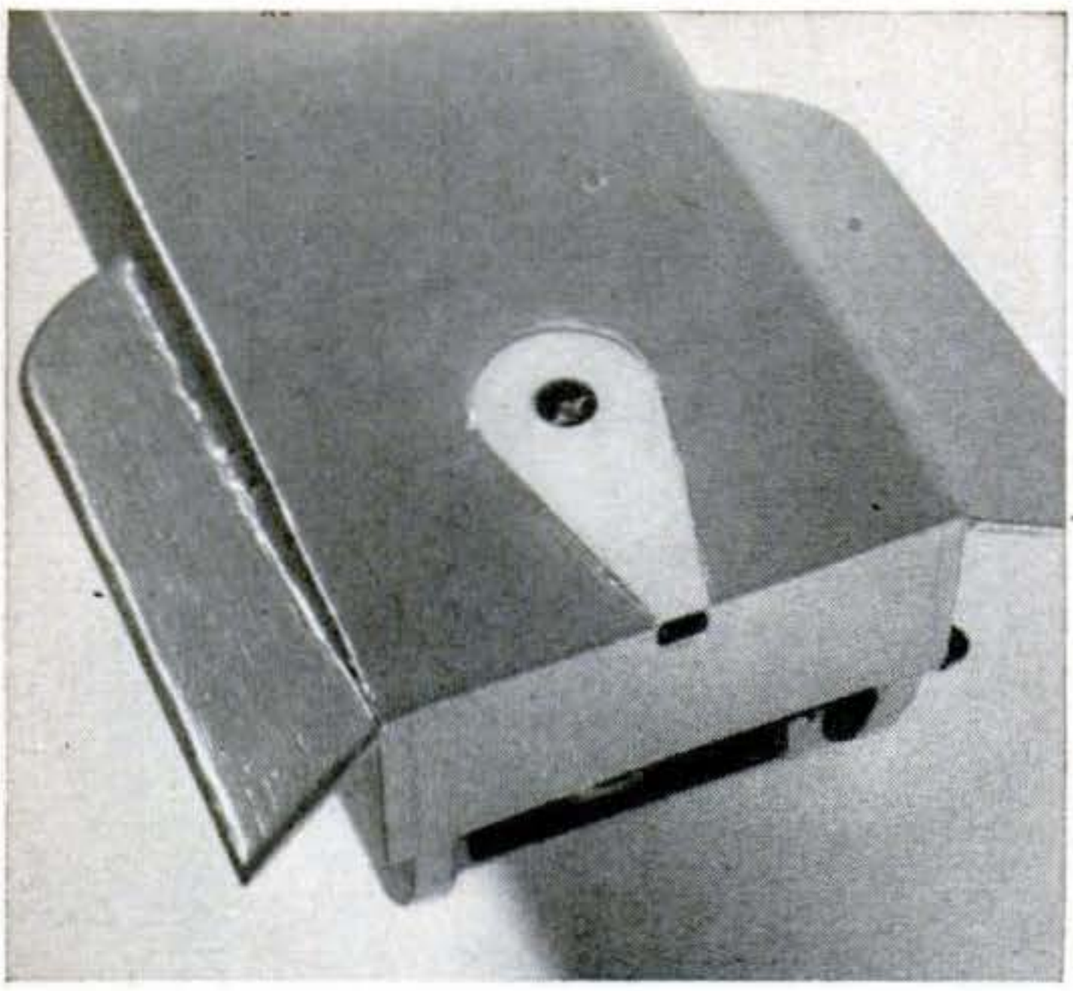


OPENING AT BOTTOM OF PUMP HOUSING takes in water which is kicked back through rectangular port at the stern. The planing angle of the hull eliminates need for a water scoop.

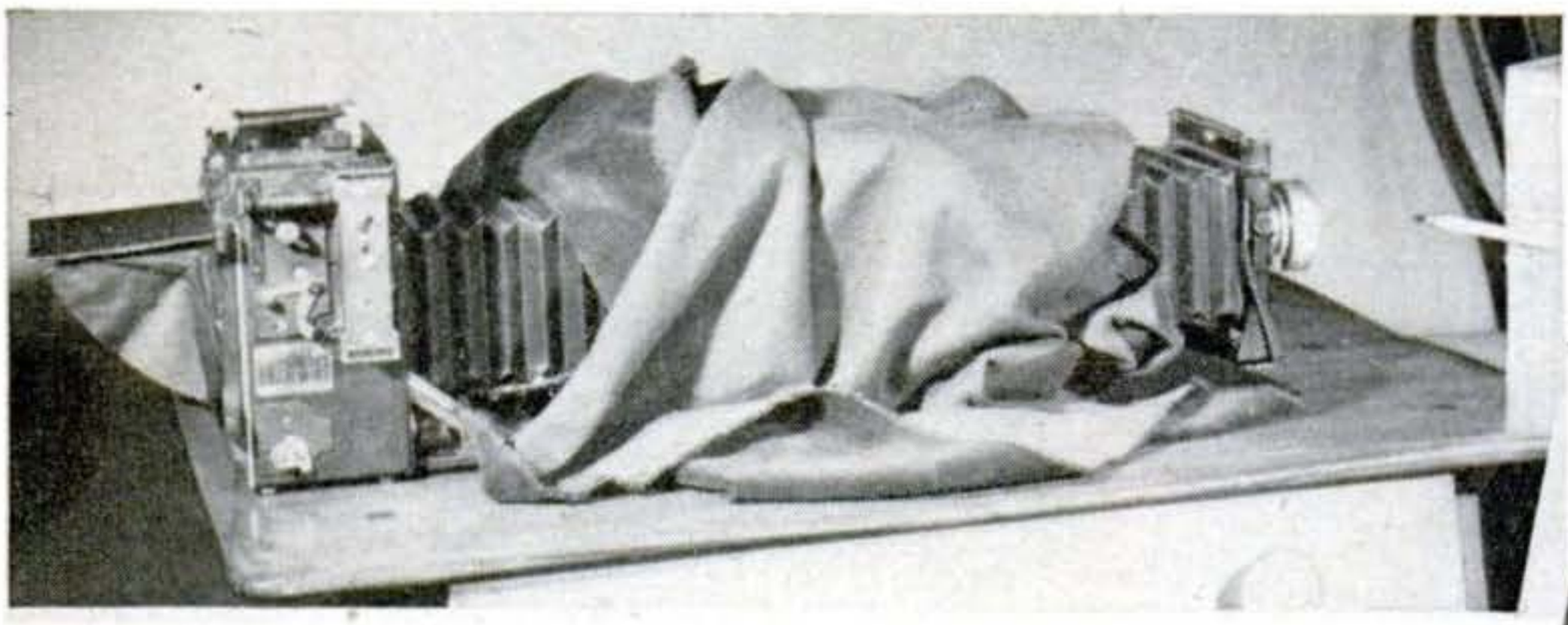
assembled and placed in the hull. The pump housing is made from a single piece of tin-can stock (see detail drawing). Dotted lines are right-angle bends, and the tab extension between the pear-shaped bottom and top sections is curved around the rotor end to form a continuation of the sides. Butting edges are soldered, starting at the nozzle to insure good alignment. Make sure that the bearing hole is centered with the larger water-intake hole. A short piece of tubing should be soldered over the bearing hole to keep the impeller shaft aligned. This impeller shaft has a slot sawed in one end to receive the blade, which is a strip of thin brass stock curved in the form of a shallow S.

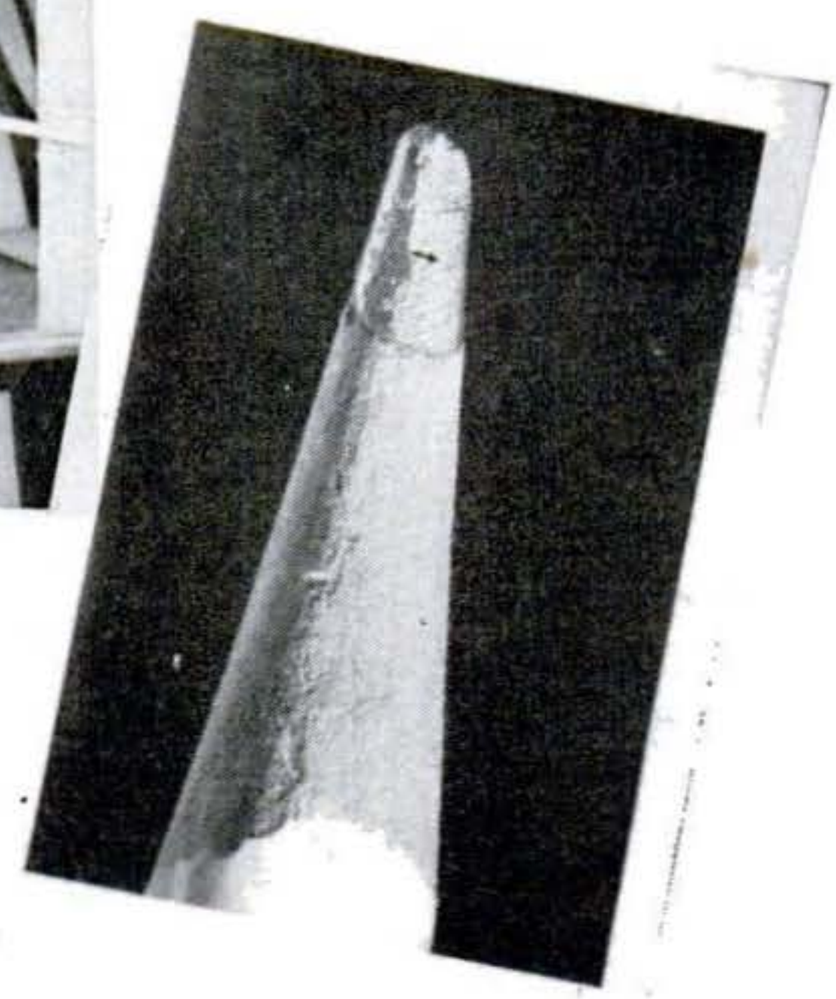
Before mounting the blade in the housing, solder a short arm, or "dog," to the top of the impeller shaft. Then tin both the slotted end of the shaft and the blade, scraping off just enough solder to let the notch slip firmly over the center of the blade. To mount, turn the housing upside down and press the shaft through the bearing from below. Drop a small washer through the water-intake hole and over the notched shaft end. Slip the blade through the nozzle with tweezers and press it onto the shaft. Rotate the shaft to make sure the blade doesn't scrape against the housing, then solder it in position.

Engine. The power plant is a miniature gas engine, suspended in a U frame of ⅛" sheet balsa directly above the impeller shaft. For the slightly angled coupling between the engine and shaft, a pin on a flywheel engages the shaft dog. The flywheel is a large iron washer backed up by a small V-groove pulley turned from hardwood. Mount the fuel tank on one side of the cockpit floor and connect it to the engine with plastic hose.

Operation. The hydrojet boat is started by winding a number of turns of string around the grooved pulley and then hauling the twine sharply back through the engine frame.

If you don't want to chase the craft with a rowboat, tether it to a line from five to six feet long. One end of the line is attached to an upright post, the other to the side of the hull nearest the fuel tank. Otherwise centrifugal force would starve the engine. END





Cameras in Tandem Make Big Close-Ups

ANY two cameras having double-extension bellows and ground-glass focusing can be paired this way to make super close-ups like the pencil point at right. Extend both bellows fully and remove the back from the front camera and the lens board from the rear one. A black cloth is put over joint to keep out light. The result is a bellows length that takes 'em big.—*Clarence Leino, West Allis, Wis.*

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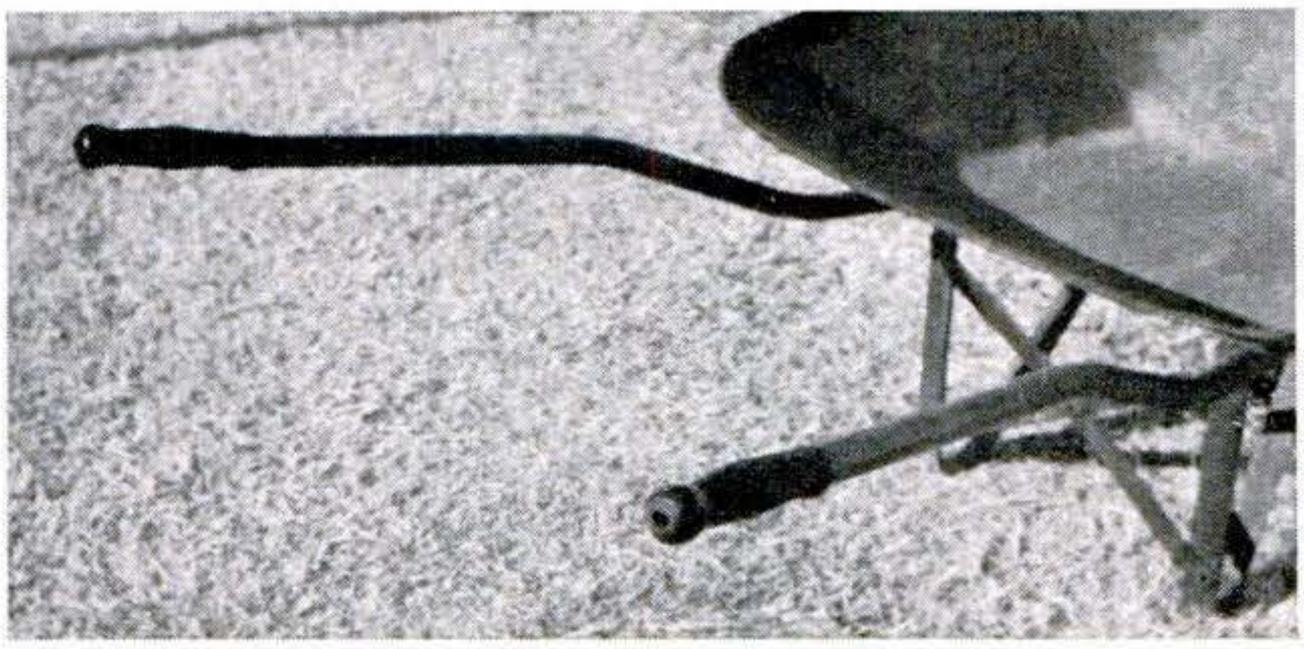
Piece of String Doubles Scale Capacity

EVER want to weigh a package with an undersize hook scale? It's simple, providing the package doesn't weigh more than twice as much as the scale capacity.

Attach one end of a piece of twine to an overhead support beside the suspended scale. Carry the other end down through an eye tied to the package, and double it back to the hook on the scale. Let the package slide to the bottom of the line. Multiply the scale reading by two, as the load is shared equally by the scale and the attached piece of string.—*Frank Yatsko, Bethlehem, Pa.*



Handle-Bar Grips Ease Work with Wheelbarrow

BICYCLE handle-bar grips shoved on the handles of a tubular-frame wheelbarrow will cushion your hand against the rough metal and prevent a lot of blisters when hauling heavy loads. Buy grips tailored to fit the hand.—*Fred M. Pease, El Paso, Tex.*

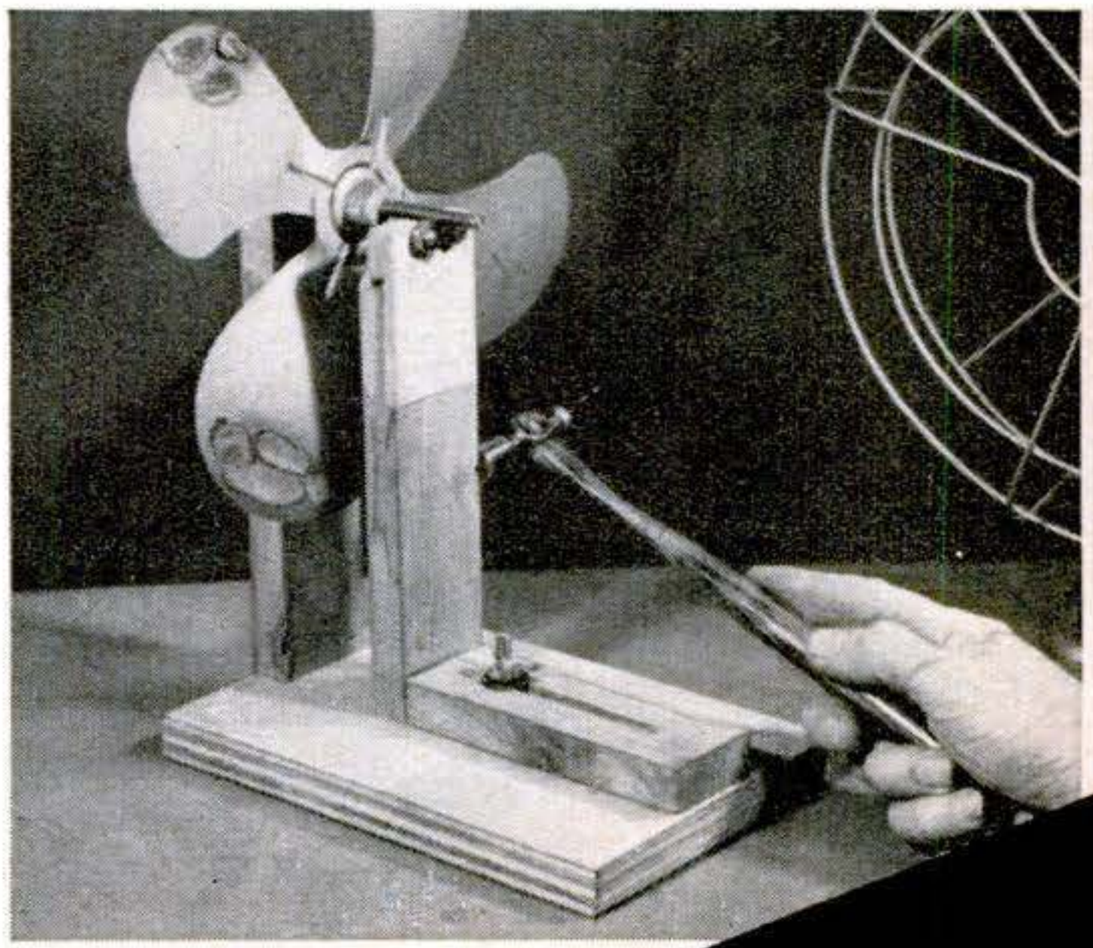
Homemade Jig Balances the Noise Out of Fan Blades in Jig Time

YOUR fan will keep you cool with less noise if you balance the blades to reduce or eliminate vibration.

Motor resistance may make this difficult when they're mounted, but it's easy to make a balancing jig. At one end of a wood base, mount an upright slightly taller than the radius of the fan. Fasten a similar upright to one end of a slotted strip secured to the base by a bolt and wing nut. This permits the spacing between the uprights to be varied. Astride a centered notch in the upper end of each upright mount a pair of roller bearings.

To balance the fan blade, rest it on the bearings on its own shaft or a piece of straight drill rod of the right diameter. If there is a considerable imbalance, the heaviest spot will move to the bottom. If there is only slight imbalance, the blade may not move. Tap lightly and repeatedly on one of the uprights. This will cause the blade to rotate until its heaviest part is at the bottom.

Achieve good balance either by adding weight to the light or uppermost side—or by removing material from the heavy side. —*Walter E. Burton, Akron, Ohio.*



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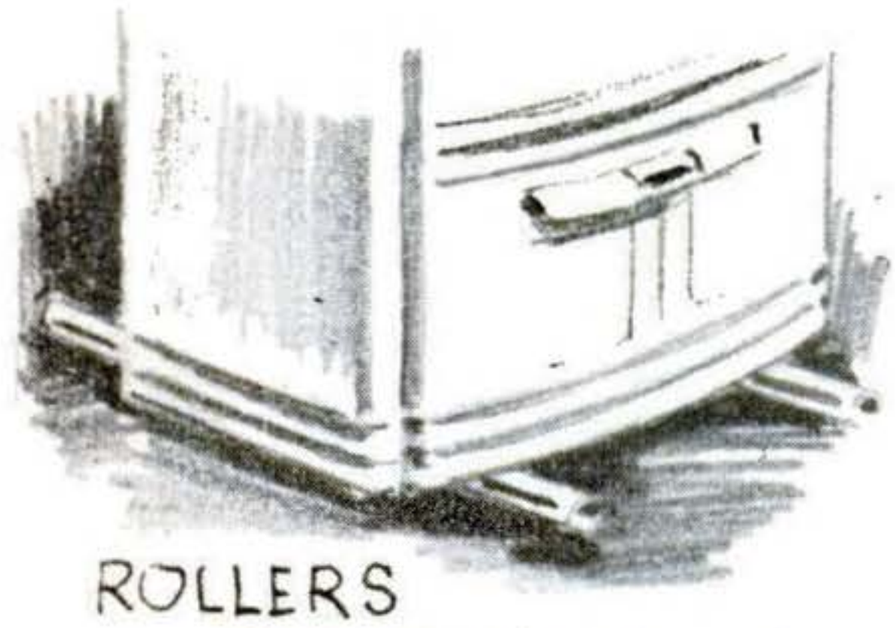
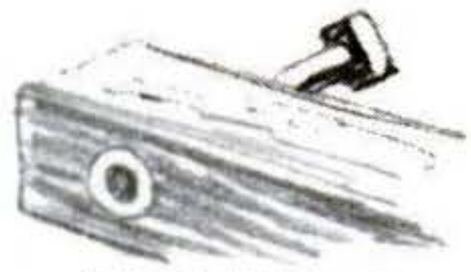
10 USES FOR Pipe Scraps

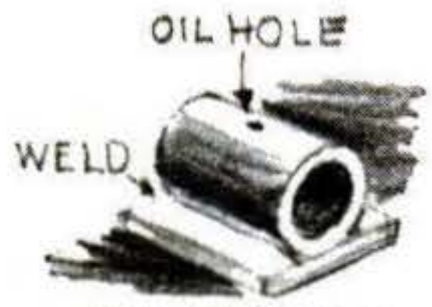


ROLLERS
FOR HEAVY ARTICLES

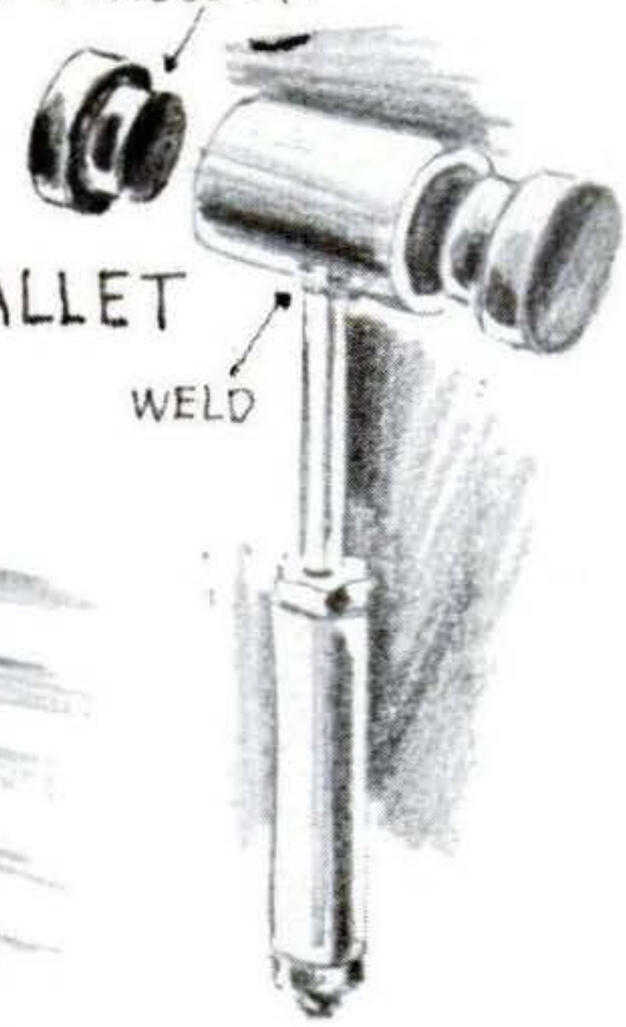


BUSHING

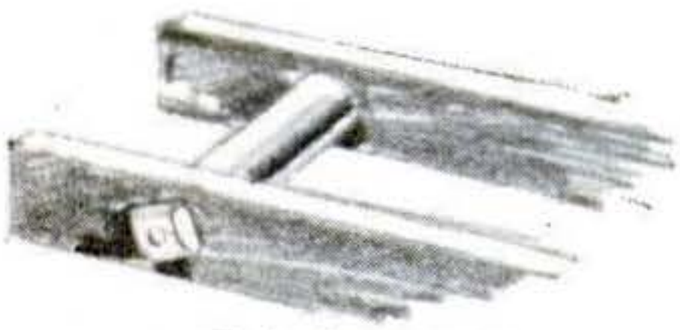
FERRULE
FOR TOOL
HANDLES



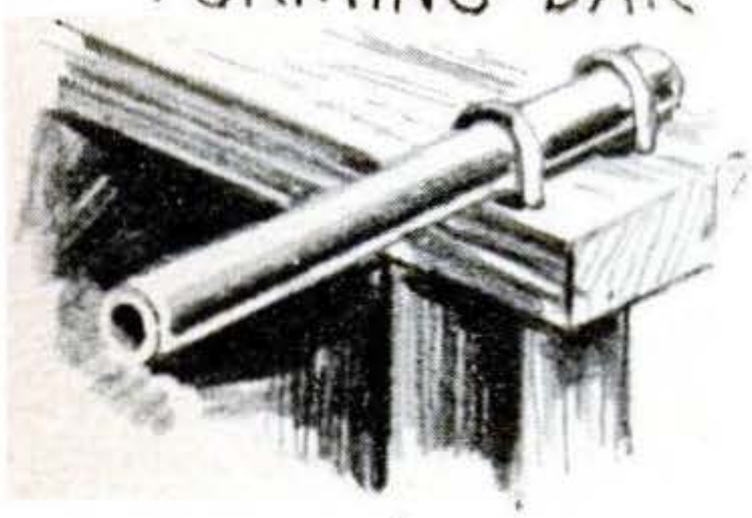
BEARING



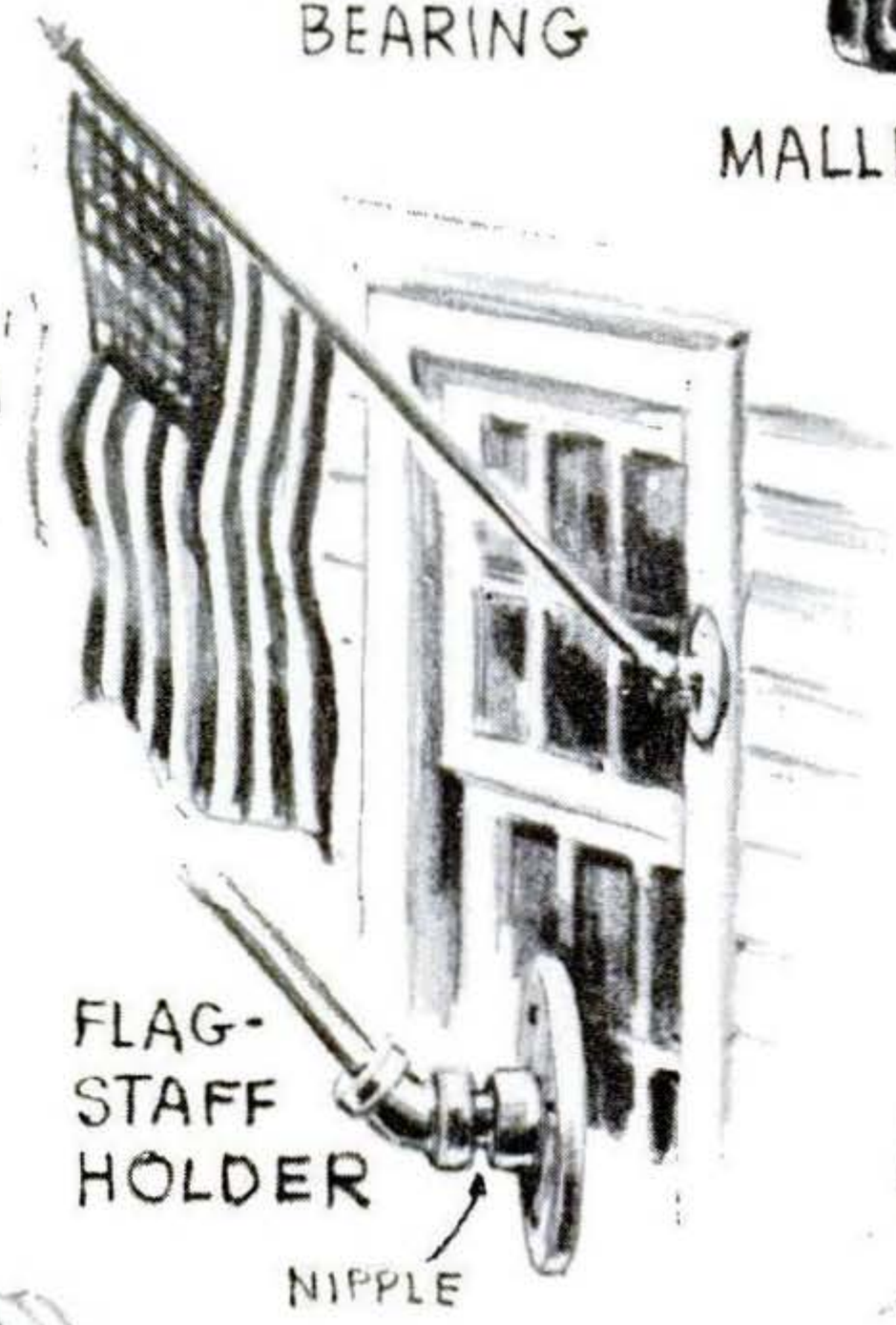
MALLET



SPACER



SHEET-METAL-
FORMING BAR



FLAG-
STAFF
HOLDER
NIPPLE

RON FURNACE

DRILL-PRESS
HOLDER
FOR PIPE AND
ROUND ROD

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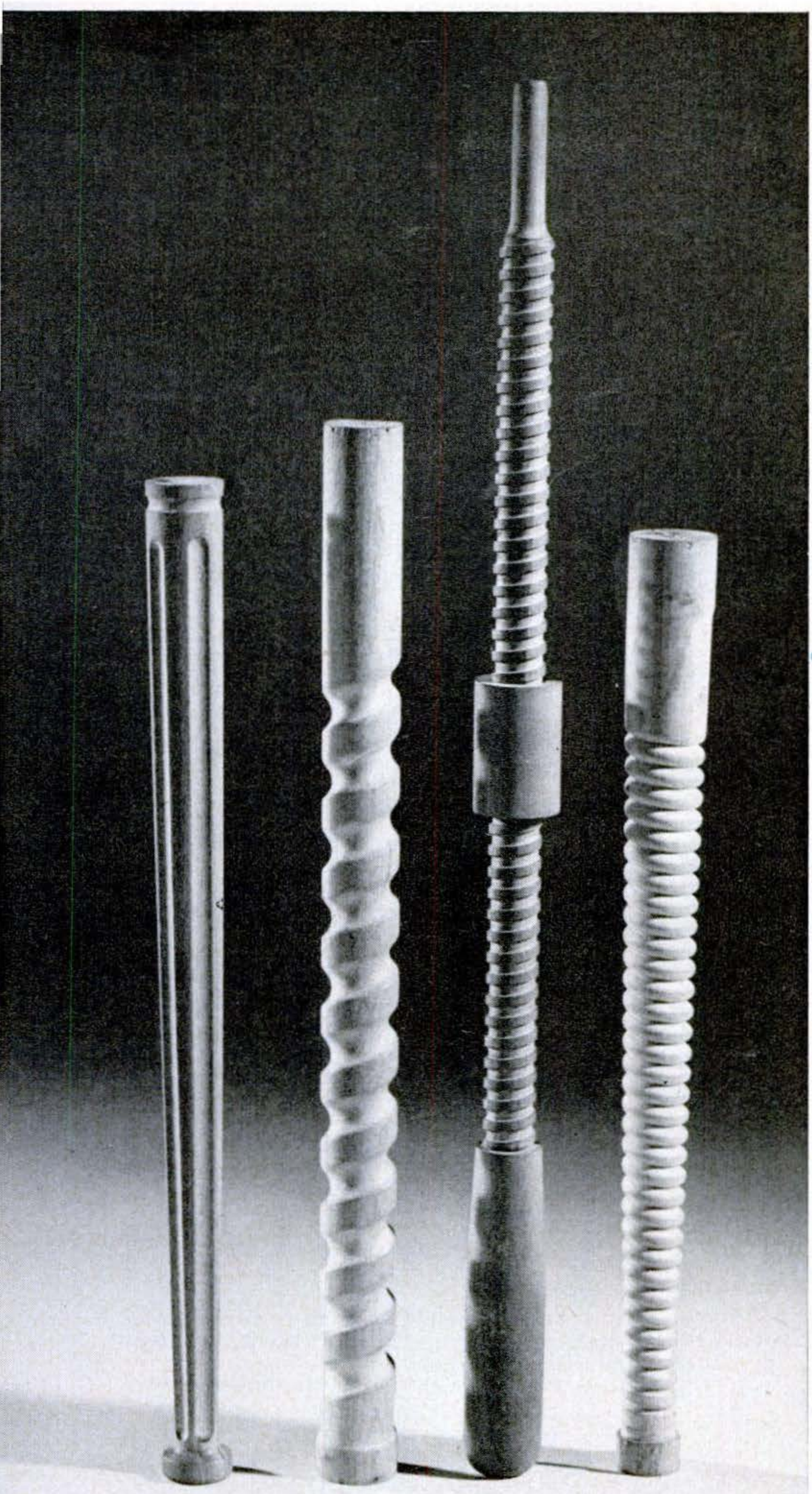

TAPERED FLUTES, SPIRALS AND THREADS, all cut in wood. Turn the page to see how you can make some just like them.

Can You Guess How It Was Done?

Tapers—Acme Made?

By Herb Pfister

NO, THESE were not made by an old-time wood turner—in fact, they weren't made by hand at all. Here's a tip: they were turned on a back-geared metal-cutting lathe, using the lead screw to advance the carriage by power feed. Now all you have to figure out is how such crisp cuts were made in wood with the slow spindle speed of a back-geared lathe. Remember, it takes plenty of speed where the cutter meets the work to shape wood without splintering it. Think those internal and external Acme threads were made with a big tap and die? Or were they cut with a chasing tool held in a hand that instinctively leads four threads to the inch? Guess again.

Give up? Then turn the page to see how your lathe and a homemade attachment work together to do these and a lot of other trick jobs that would be tough to do by any other method.

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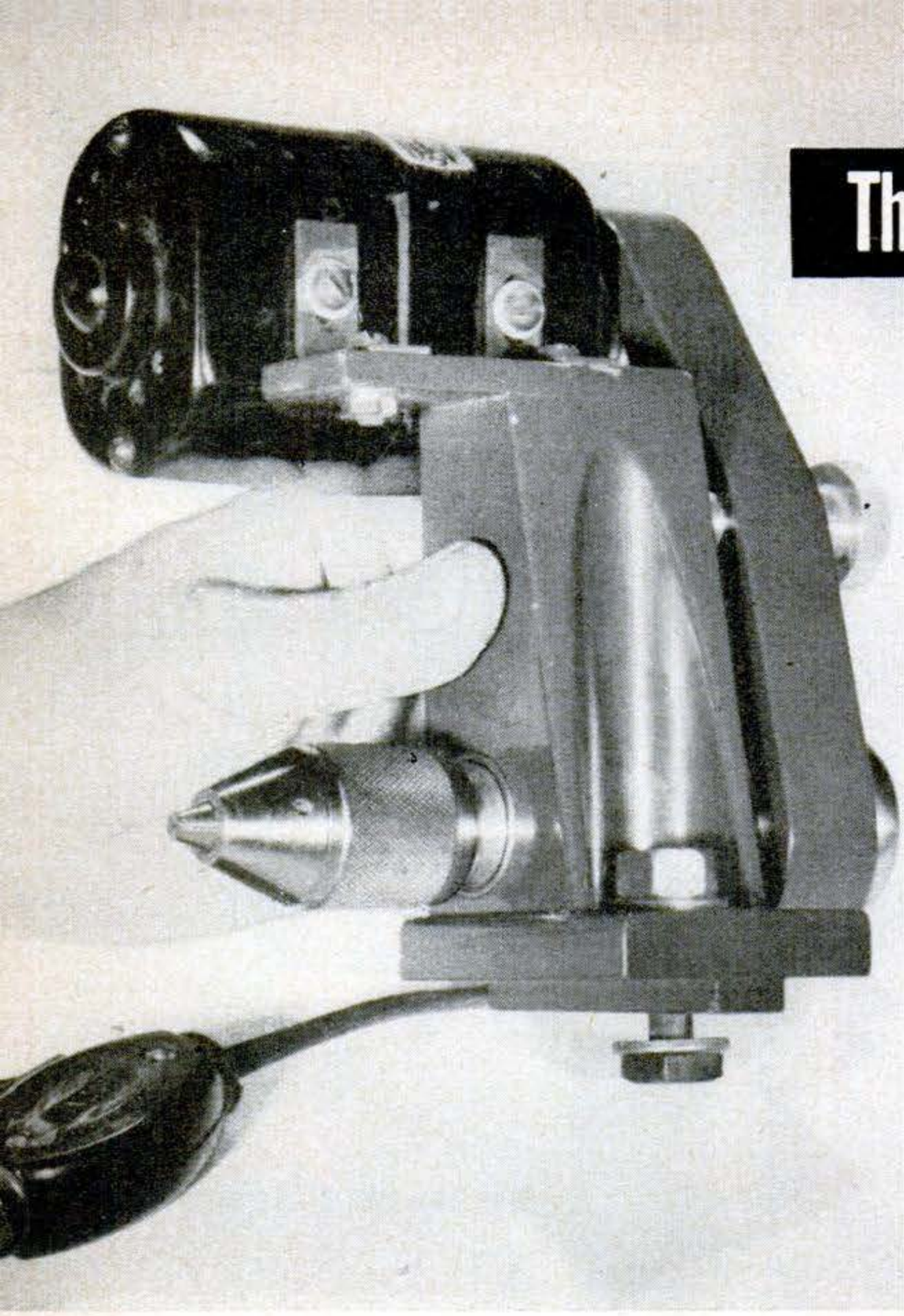


This Attachment Does the Job

YOU can make one like it at home. It's a tool-post router with a chuck to drive a variety of router bits and burrs of different shapes. Bolted to the T slot of the lathe compound, it does the actual cutting at high speed while the lathe turns slowly in back gear, moving the carriage along at coarse feeds such as four threads per inch.

Mounted on the lathe compound, the spindle is at the same height as the lathe centerline, but it can be bolted to an auxiliary block clamped in a lathe milling attachment for cutting above the work, as when undercutting insulation in an electric-motor armature.

Four typical setups for turning flutes, spirals and threads are shown at right.

How to Build the Attachment

SHAPE the body from a piece of 1¾" maple. Dress all surfaces parallel, cut the recess for the clamping bolt and smooth it with a 1"-diameter drum sander in the drill press. Bore snug-fitting recesses for the ball bearing with a circle cutter set to slightly less than the diameter of the bearing's outer race. Clean up the recesses and bring them to the required depth with a flat-bottomed router. Drill a 9/16" hole through the two recesses for the ½" spindle. Glue body to a T-shaped base cut to fit in the lathe compound.

Make the spindle from a 4½" length of ½" rod and thread it in the lathe to match the threads of the chuck you're using. Turn and fit the handwheel, step pulleys and collars, and assemble the spindle on two ½"-bore ball bearings pressed into the recesses.

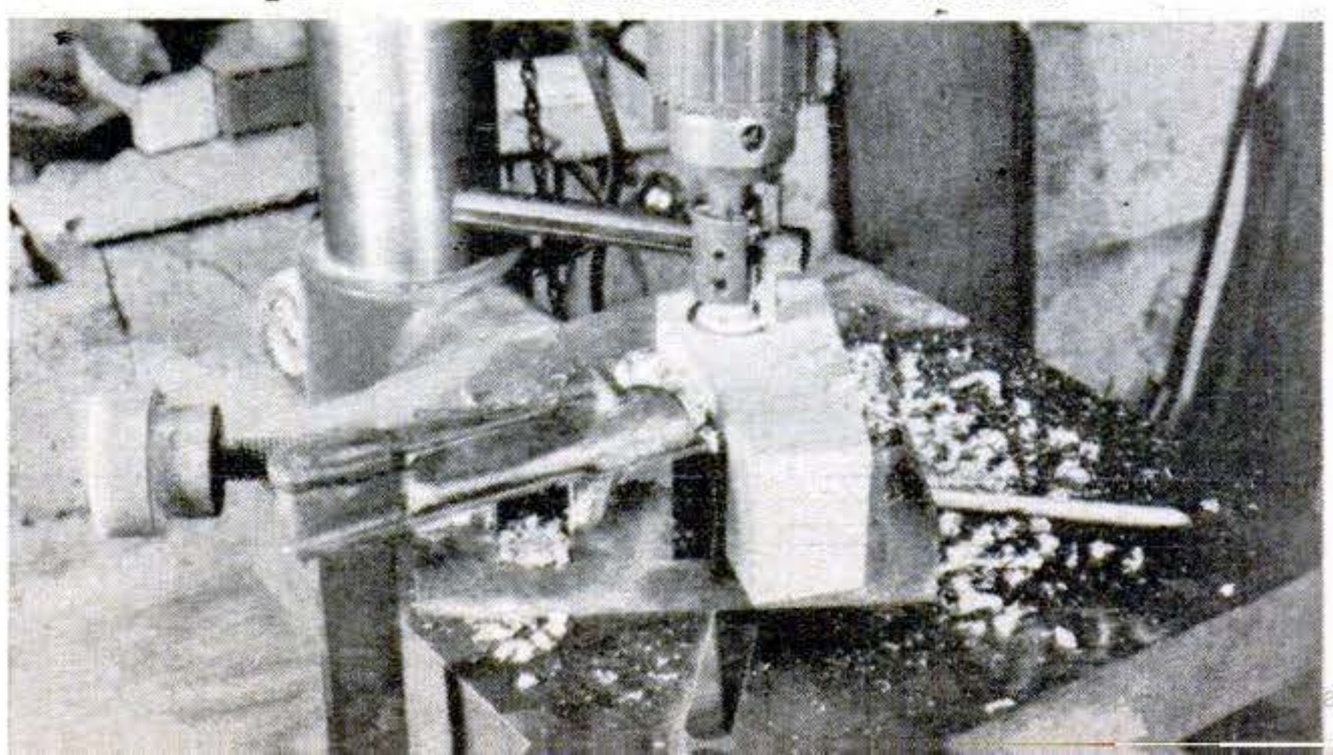
Glue a ¼"-thick block of maple to the top of the body and fasten a sewing-machine motor to it with two steel angles. Check the rotation of the motor; it must run counterclockwise to turn the spindle clockwise, seen from the handwheel end. If necessary, reverse its rotation by switching the wires leading to the brush terminals.

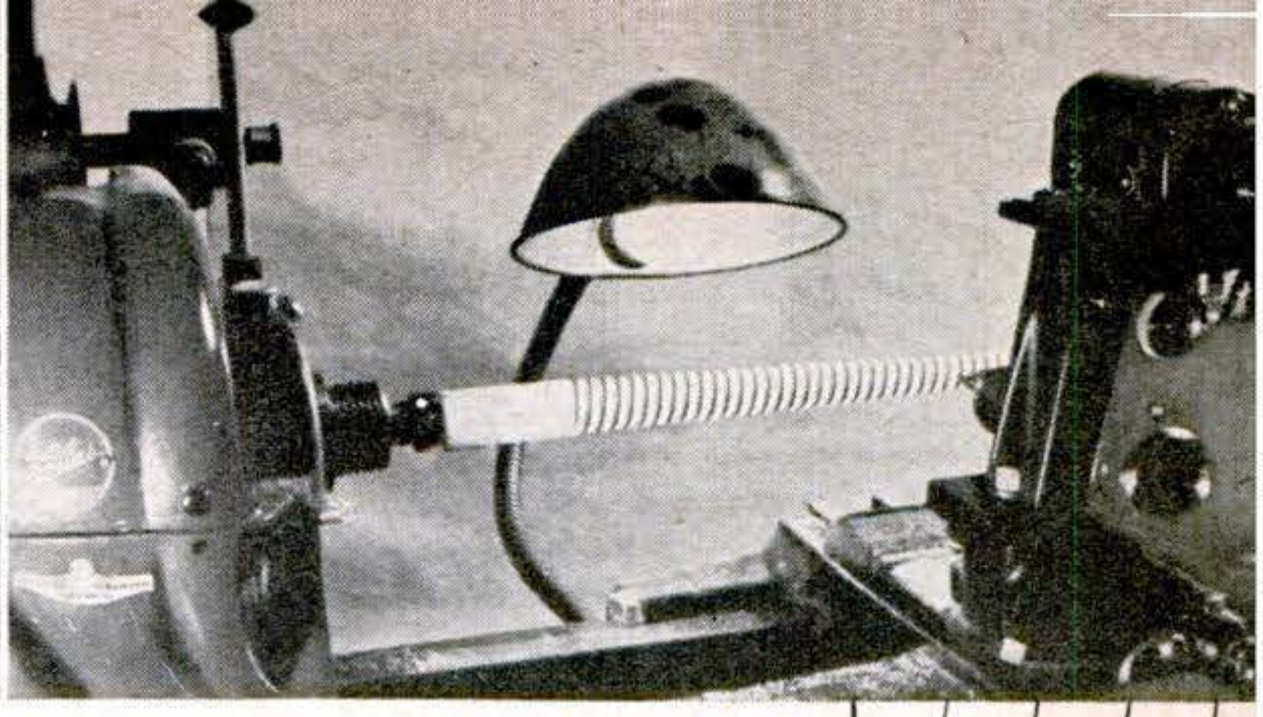
A round rubber sewing-machine belt drives the spindle. Cut the belt guard from a strip of ¾" maple and fasten it over the pulleys with a thumbscrew and a ¼" stud driven into the side of the body.

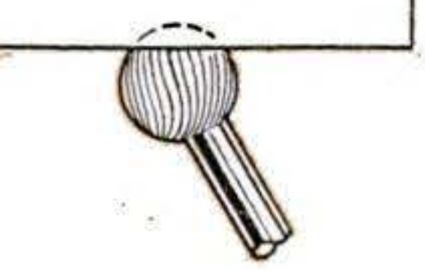
Bolt the attachment to the lathe compound with a ⅜" bolt and a washer filed to fit the T slot, and give it a trial run before painting. Finish with a coat of shellac followed by a coat of machine-gray enamel.

For use with the lathe's milling attach-

CUT BEARING RECESSES with a circle cutter. Make trial settings in scrap wood for a tight fit. Remove center material and bring recess to depth with a flat-bottomed router.

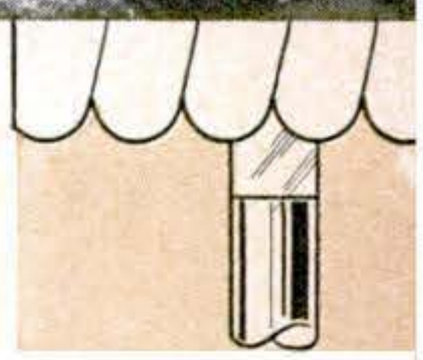


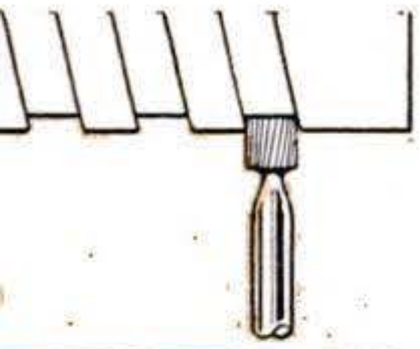




FLUTING. Tapered turnings, made with tailstock set over, are fluted with round router bit chucked in attachment. Compound is set at 30° angle to let side of router do the cutting. Flutes are cut in several successive passes.

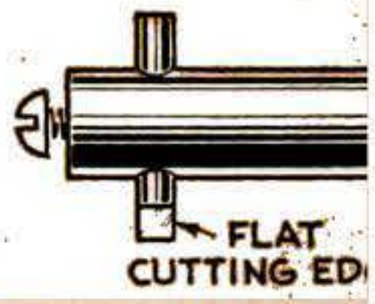
BEADING. Beading bit is fed straight into work. Carriage is moved by lead screw with gear set up for coarse feed of four threads per inch. Lathe spindle is turned at slowest back-gear speed so cutter can work.

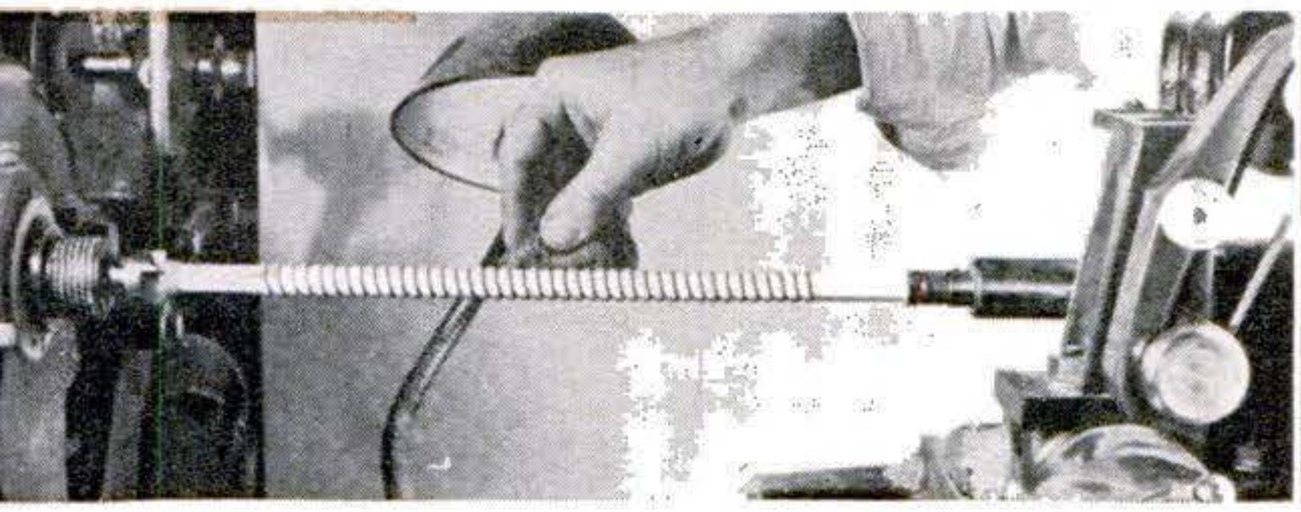




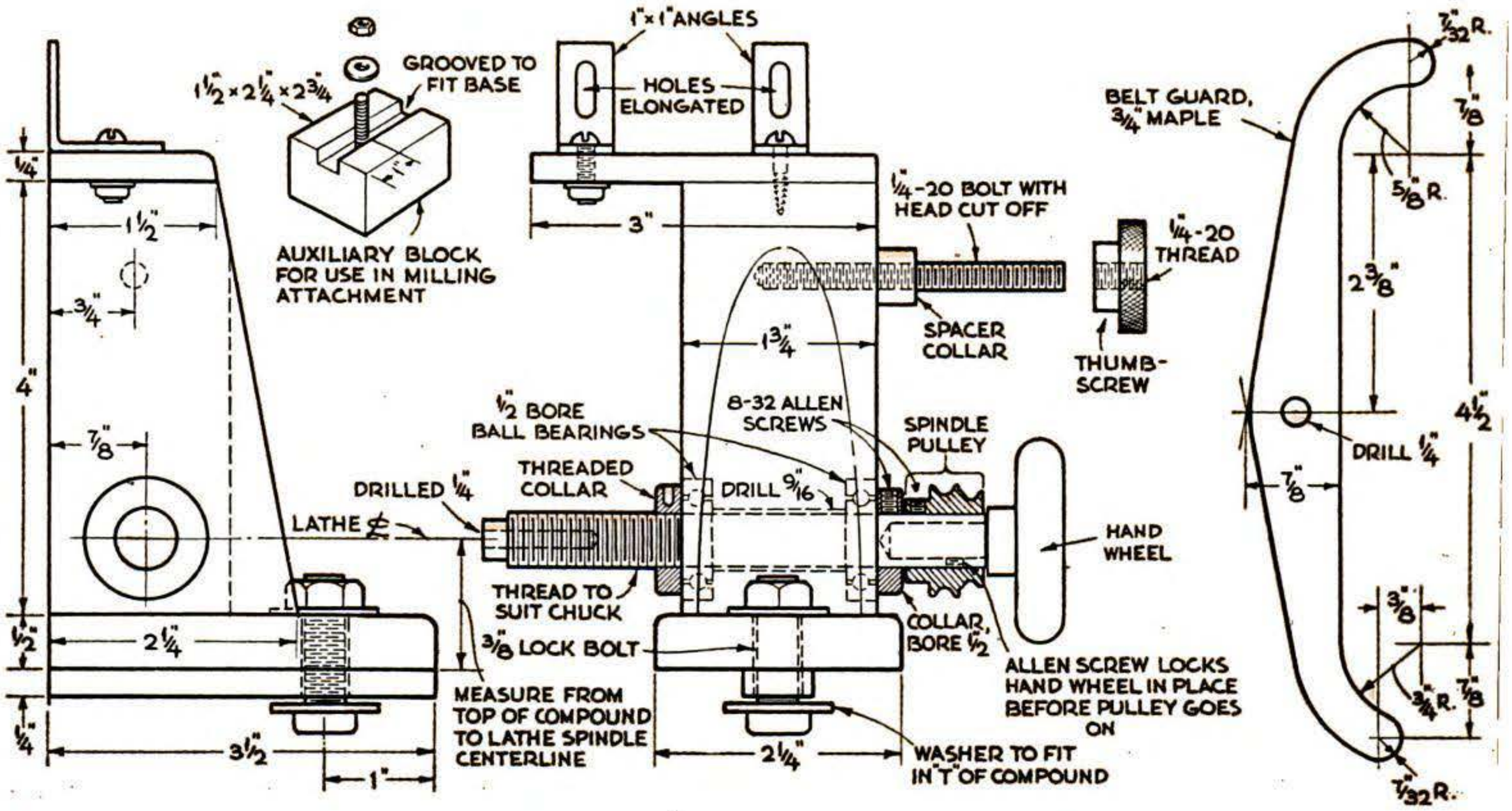
THREADING. Four-threads-per-inch Acme thread is cut in hardwood dowel with 1/8"-diameter flat-bottomed bit. Touch with steel wool to smooth the cut. Pieces like this let you make your own cabinetmaker's clamps.

INTERNAL THREADING. One of the hardest jobs in woodworking, this is easily done with a threading bit, made from 1/4" brass rod and 1/8" drill rod. It chews out Acme thread that exactly matches threaded dowel.





ment, make an auxiliary block of maple with a groove down its center to fit the T base of the spiral cutter. Bolt the cutter to this block and clamp the overhanging end in the jaws of the milling attachment. This permits vertical adjustment of the cutter as well as the horizontal motion provided by the compound. END



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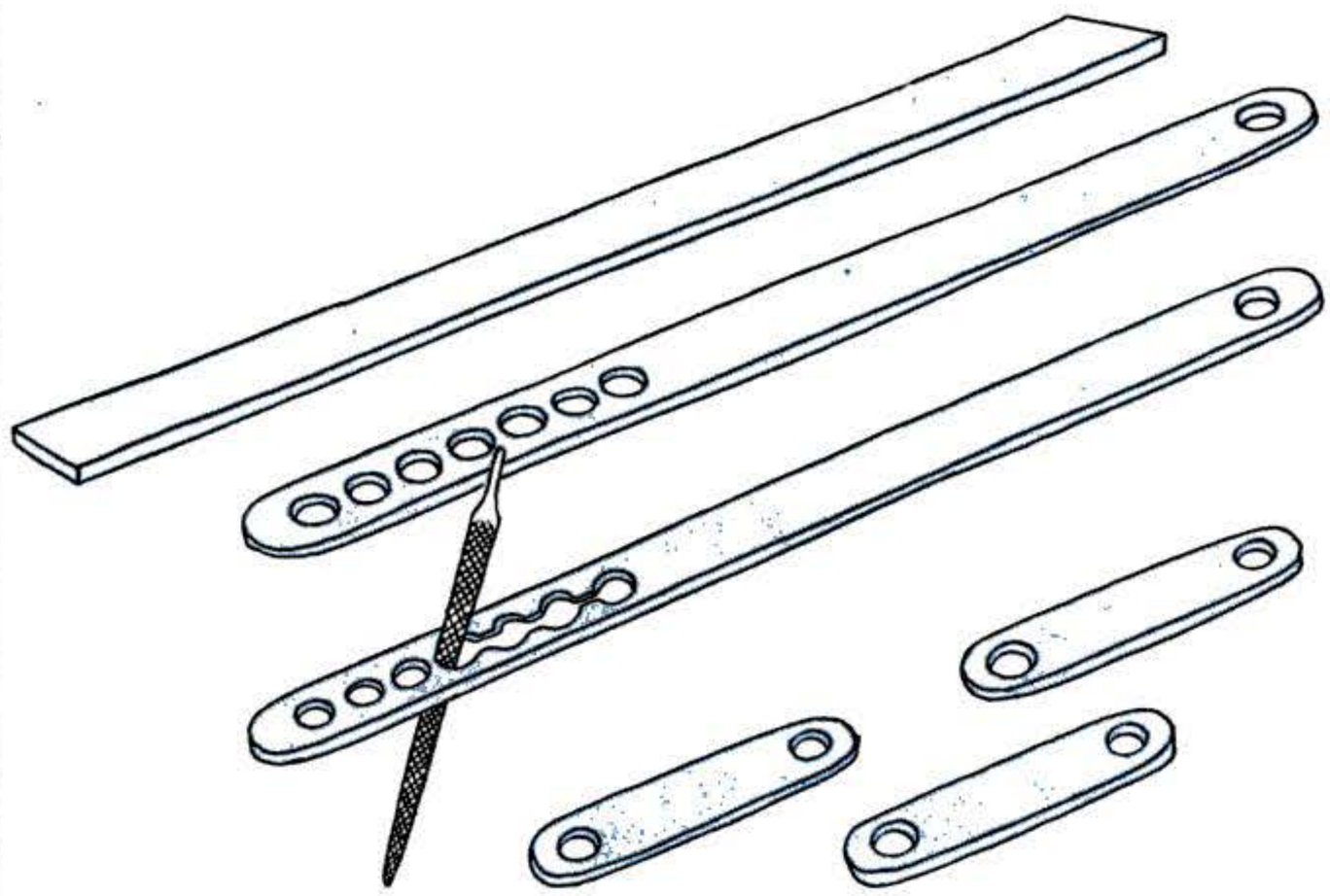
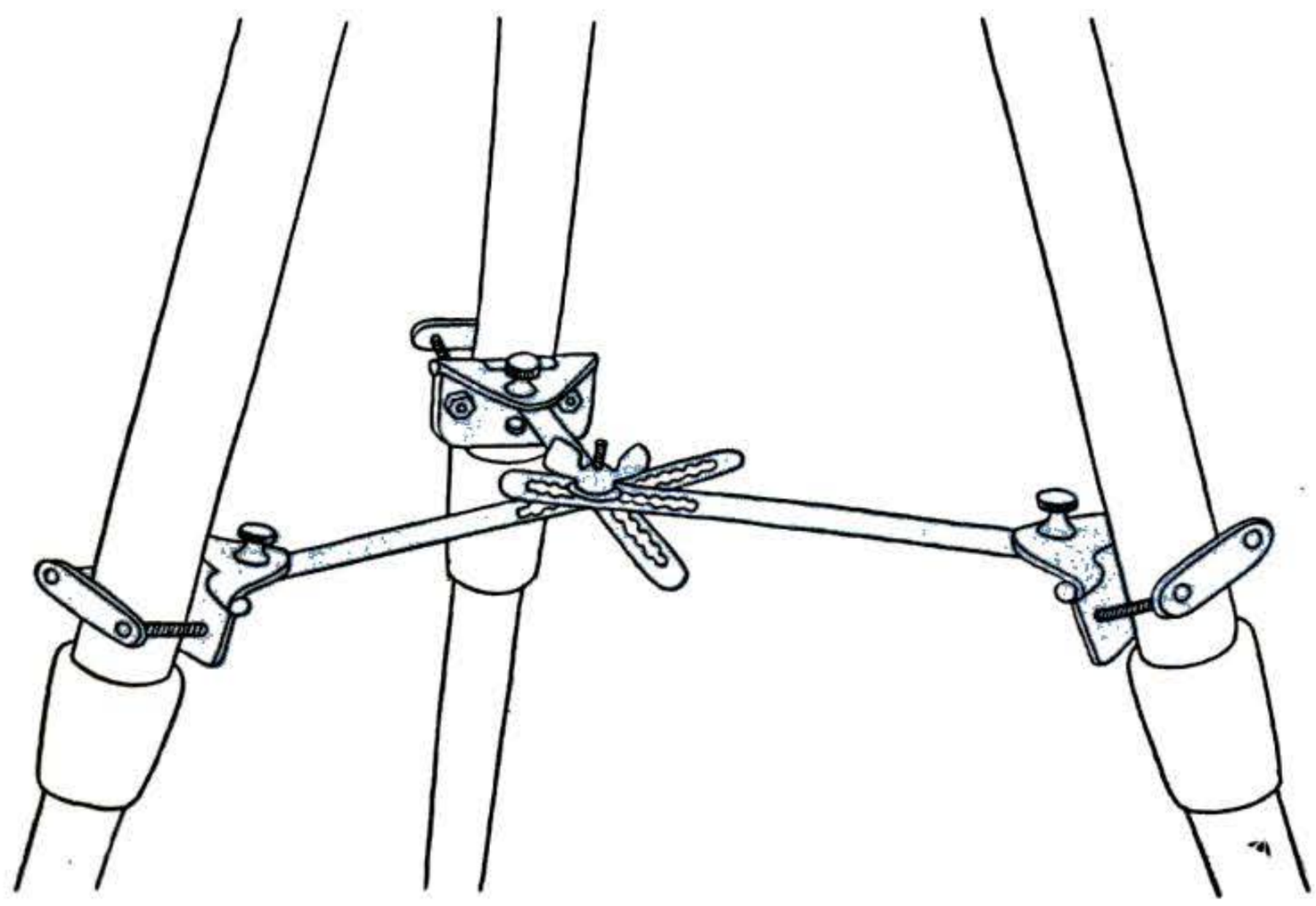
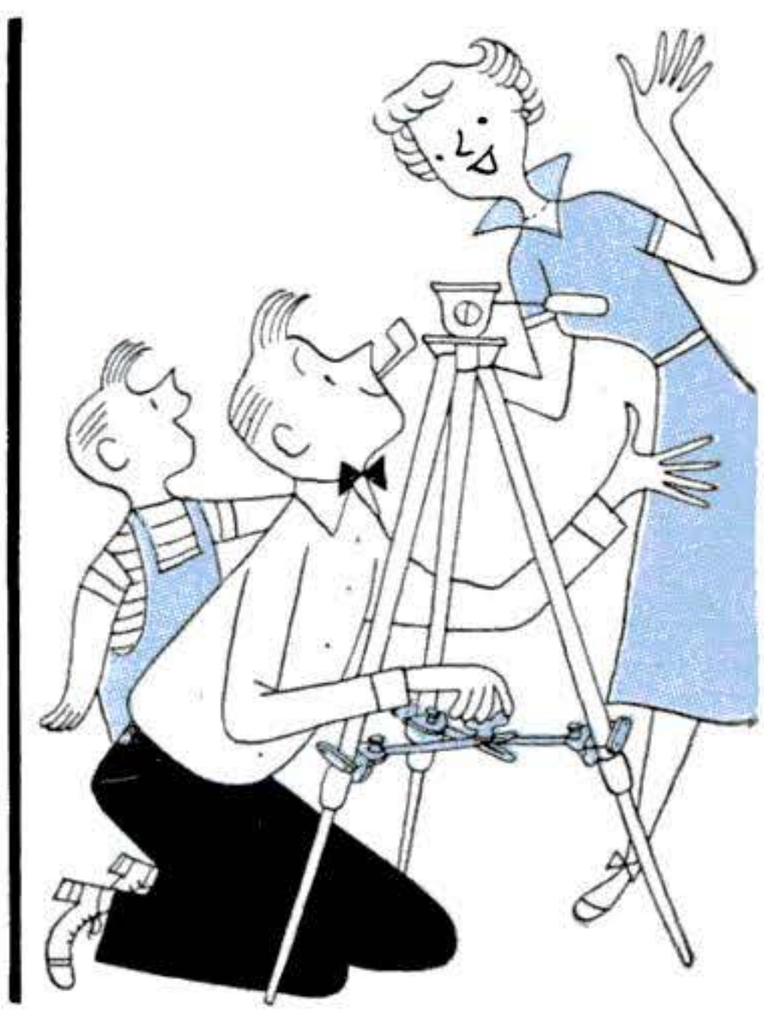
By Roy Doty and Robert Hertzberg

Wordless Workshop







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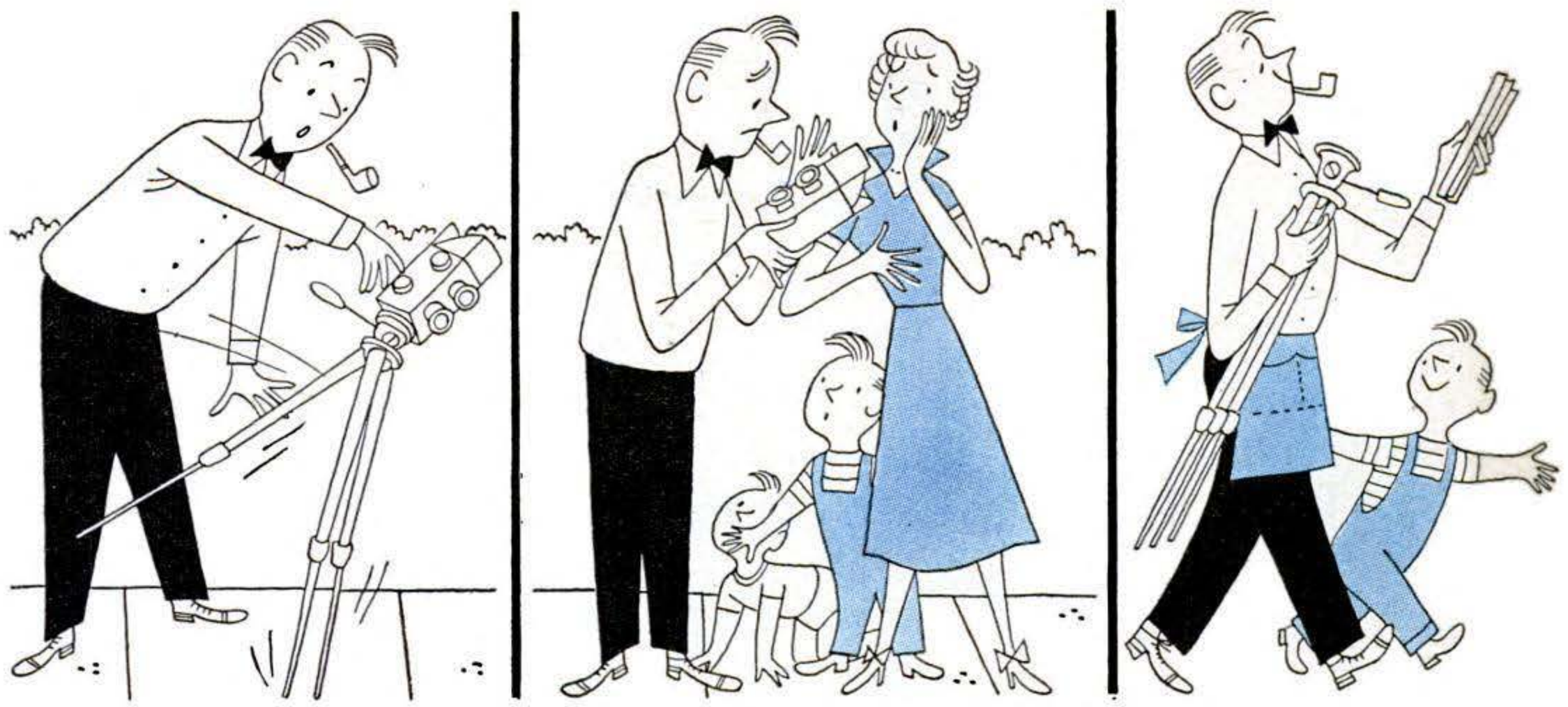

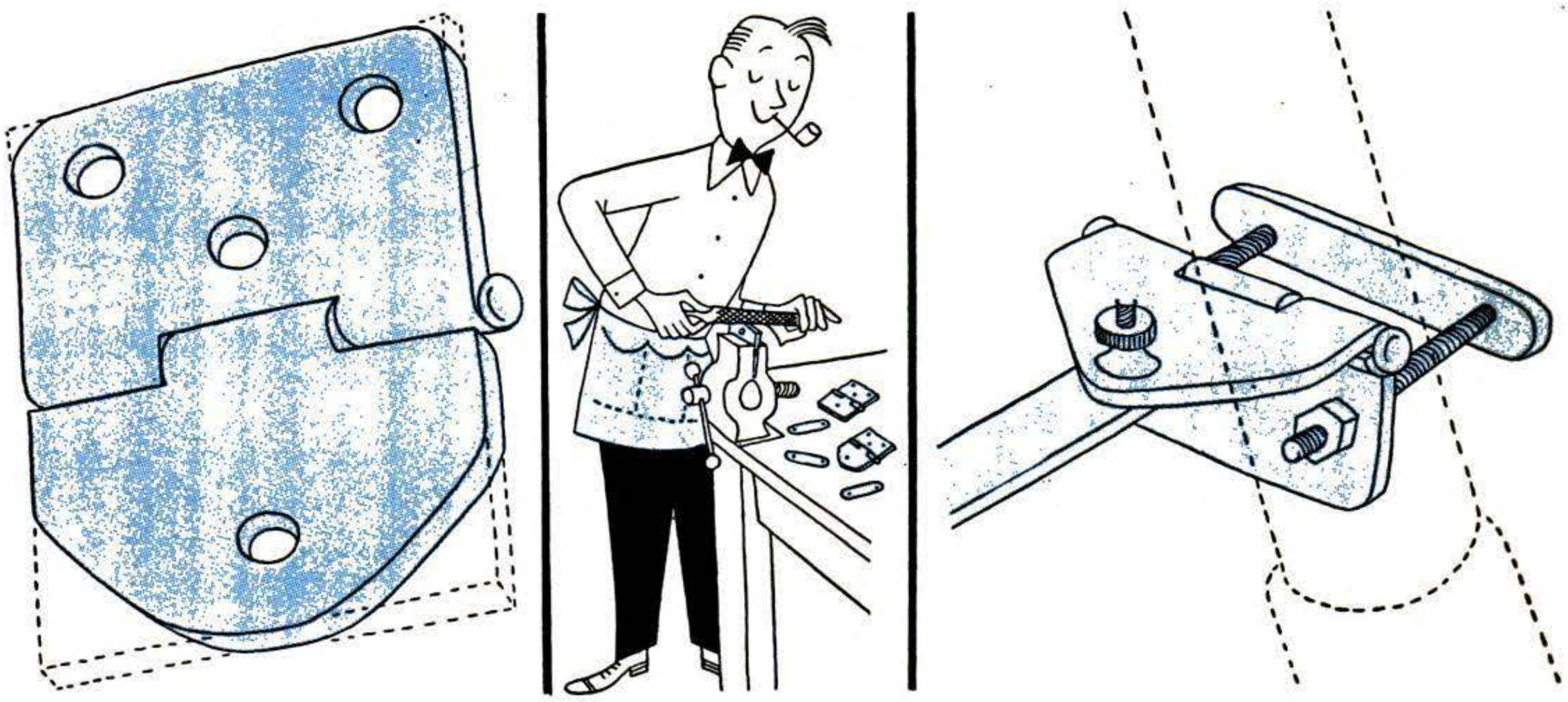

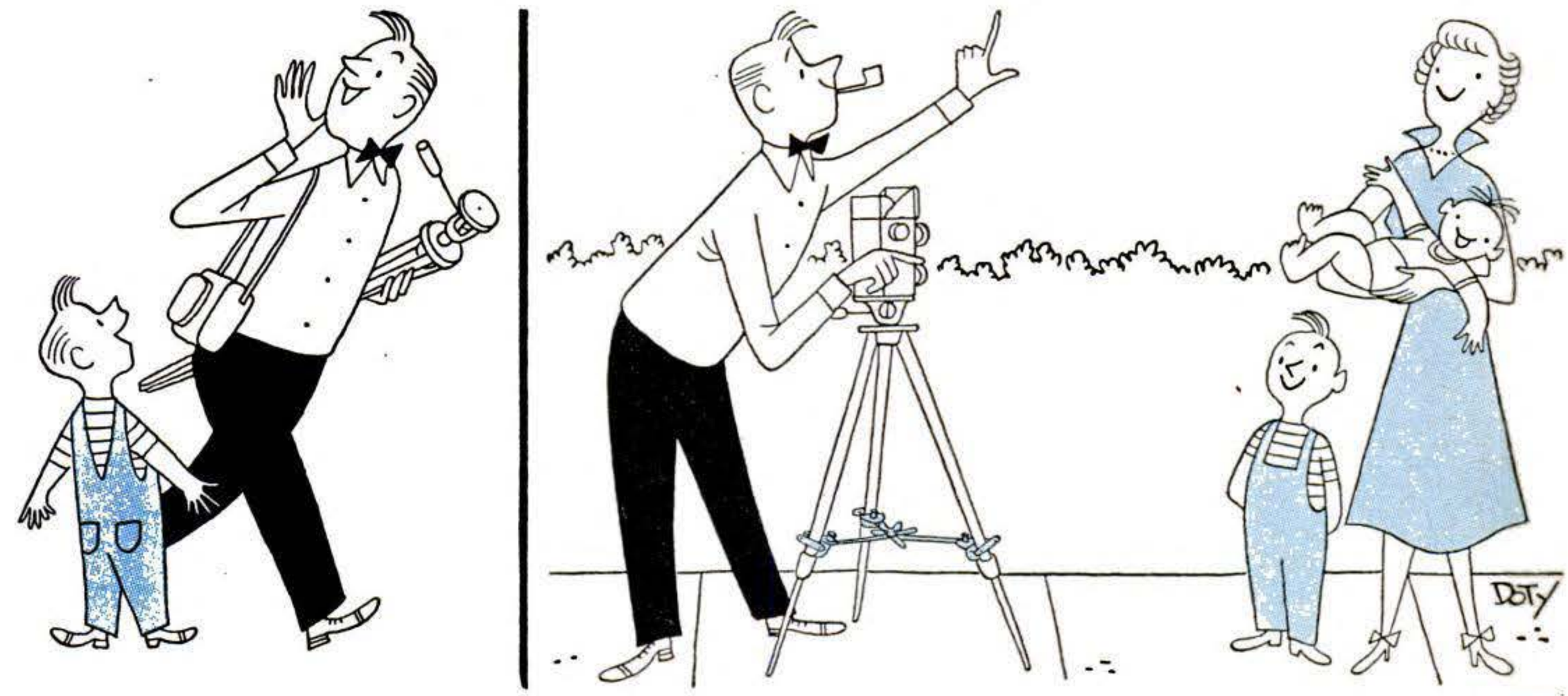

Next Month: A sewing kit for the housewife.

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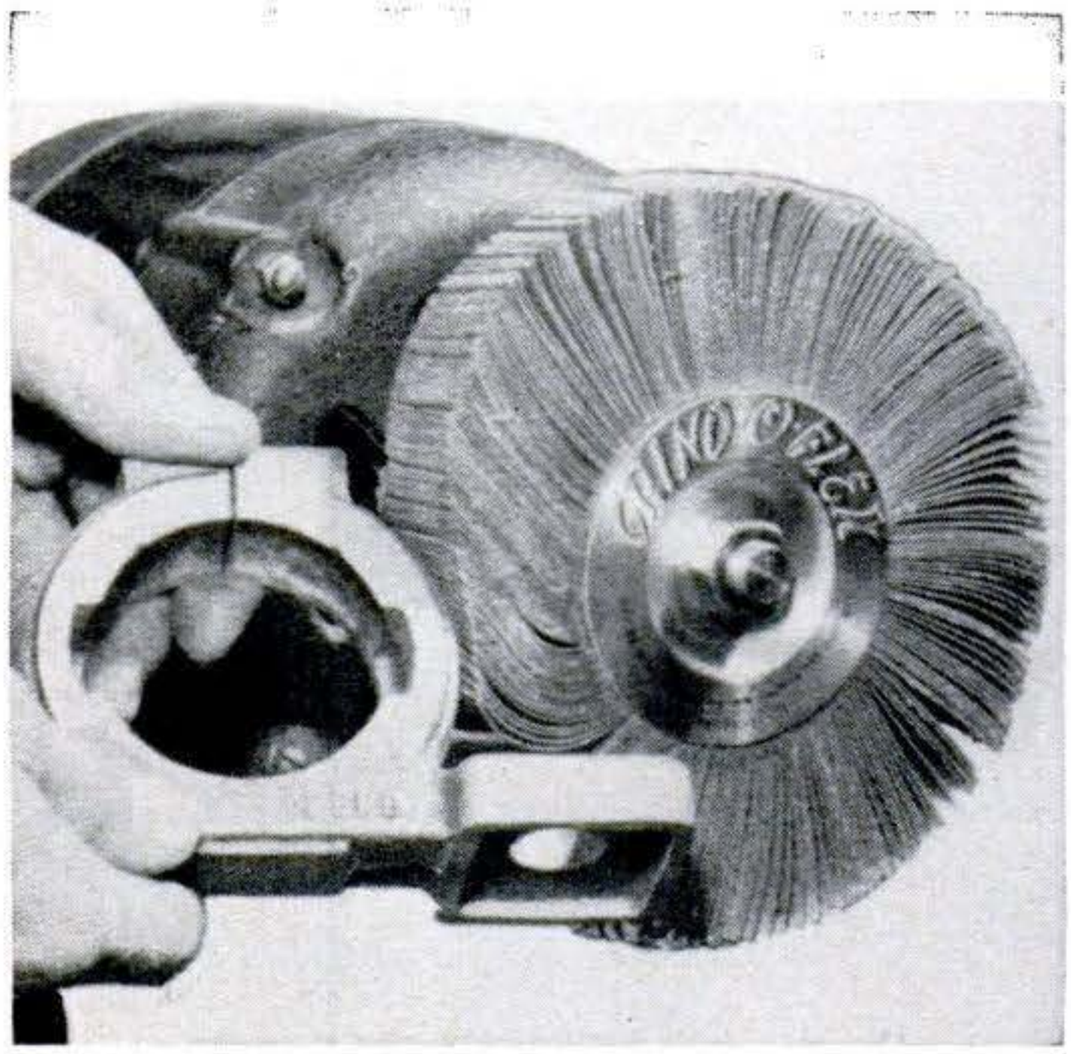
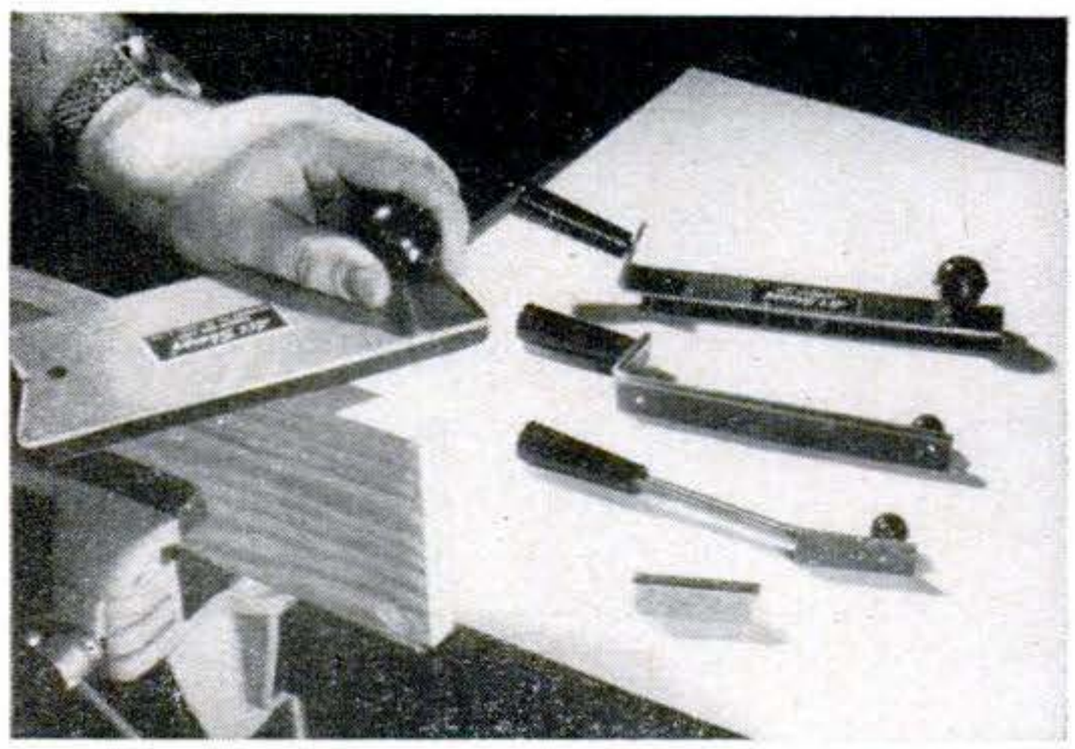
New Tools

1. Calibrator Figures Rafter Lengths. Knowing the pitch and run of a roof, you can quickly determine the length of hip, common or valley rafters. A calibrated scale transposes the run into feet of climb according to the pitch. You can get the rafter length by stepping off the dividers.



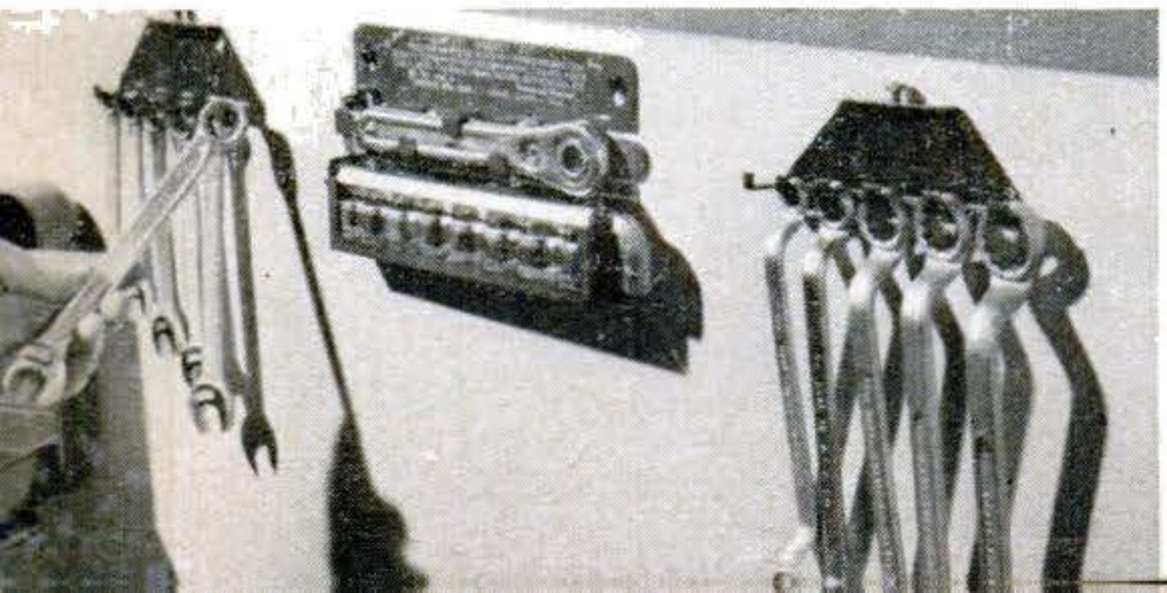
2. Flexible Grinding Wheel Smooths Contours. Hundreds of abrasive-cloth leaves sealed to a hard core present a continuous but flexible abrasive surface to metal parts. Using it, there is no danger of digging in, as with a hard abrasive wheel. It comes with arbor and centering flanges for use with a motor or flexible shaft.

3. Steel Rule Has Swivel Tip. Instead of remembering to deduct 1/32″ from an inside measurement made with most hook-tip rules, just swing the tip of this one out of the way to bring the end of the rule against the work. The rule can be had in lengths up to 10 feet and has a tape lock.



5. Sander and Files Have Adjustable Handles. These holders for files and sandpaper have two handles for accurate and comfortable working in any position. Files are interchangeable and are made in a variety of patterns. Sandpaper is applied to a cushion on the sanders with a pressure-sensitive adhesive that lets you peel it off easily for quick replacement.

4. Holders Hang Wrenches on Wall. Each of these wrench sets is packed in a holder which can be screwed to the workshop wall, displaying the tools for quick selection. A wide assortment of box, socket and open-end wrenches is available.



Further information on these tools can be obtained from:
1. Mears-Rodden Co., 6524 East 4th Place, Tulsa, Okla.;
2. Merit Products, Inc., 4023 Irving Place, Culver City, Calif.;
3. Master Rule Mfg. Co., 40 Mulberry St., Middletown, N.Y.;
4. Indestro Mfg. Corp., N. Kildare at Schubert, Chicago 39, Ill.;
5. The Milwaukee File Co., 1567 W. Pierce St., Milwaukee 4, Wis.

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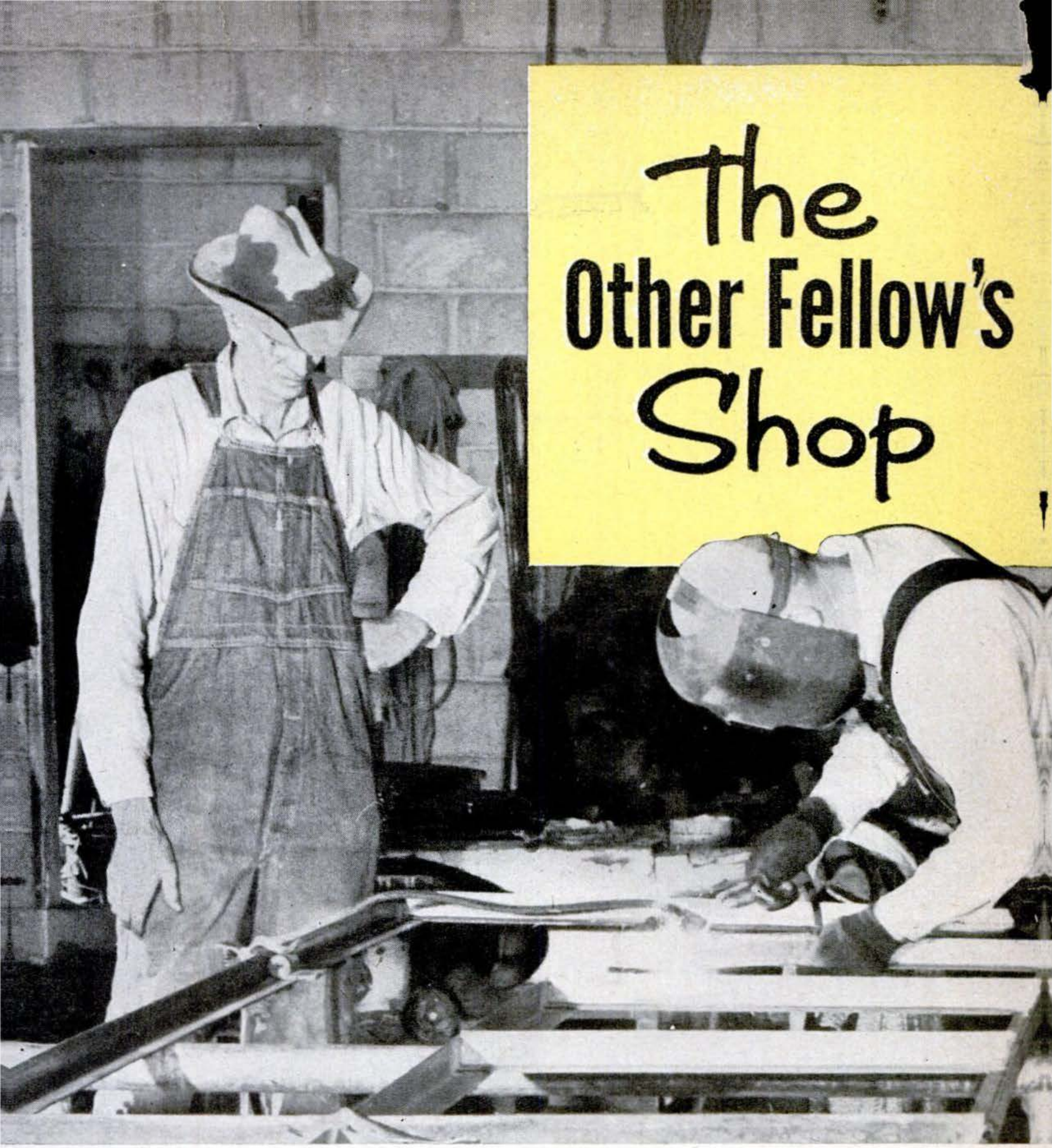

The Other Fellow's Shop

Farmer-welder-inventor P. J. Crews has 'em coming from hundreds of miles for his home-grown farm equipment.

By Murrelle Mahoney

IF YOU asked P. J. Crews of Fitzhugh, Okla., whether he is a farmer or welder, he probably wouldn't know. P. J. works at both so successfully that he belies the old saw about Jack-of-all-trades, master-of-none. And the welding trade comes in mighty handy around a farm.

There is always some kind of tinkering to be done, some piece of machinery that needs a bit of fixing. But his real specialty is the original,

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practical equipment that he designs and turns out in his farm welding shop.

Crews builds cattle guards, metal ranch gates, special types of cattle feeders that don't waste feed, fancy aluminum truck canopies for transporting Shetland ponies. County residents have grown accustomed to seeing his truck coming down the road carrying some peculiar-looking contraption or other. They usually stop to give Crews' latest brain child the once-over.

When he first set up his shop, a few years ago, so many of his neighbors came around wanting something repaired or built that he now devotes most of his time to jobs for other people.

Just What the Doctor Ordered

During the war he even turned his craftsmanship to further the cause of medicine. When fine-tempered steel was hard to get, a bone surgeon in Oklahoma City, where Crews was working in a blacksmith shop, came to see him. His delicate bonescraping tools were wearing out; he wondered if Crews could copy them.

This is the fourth of a series of articles about outstanding home workshops, from which everyone who has a shop may pick up a few helpful pointers.

See POPULAR SCIENCE MONTHLY *next month for a story on another fellow's shop.*

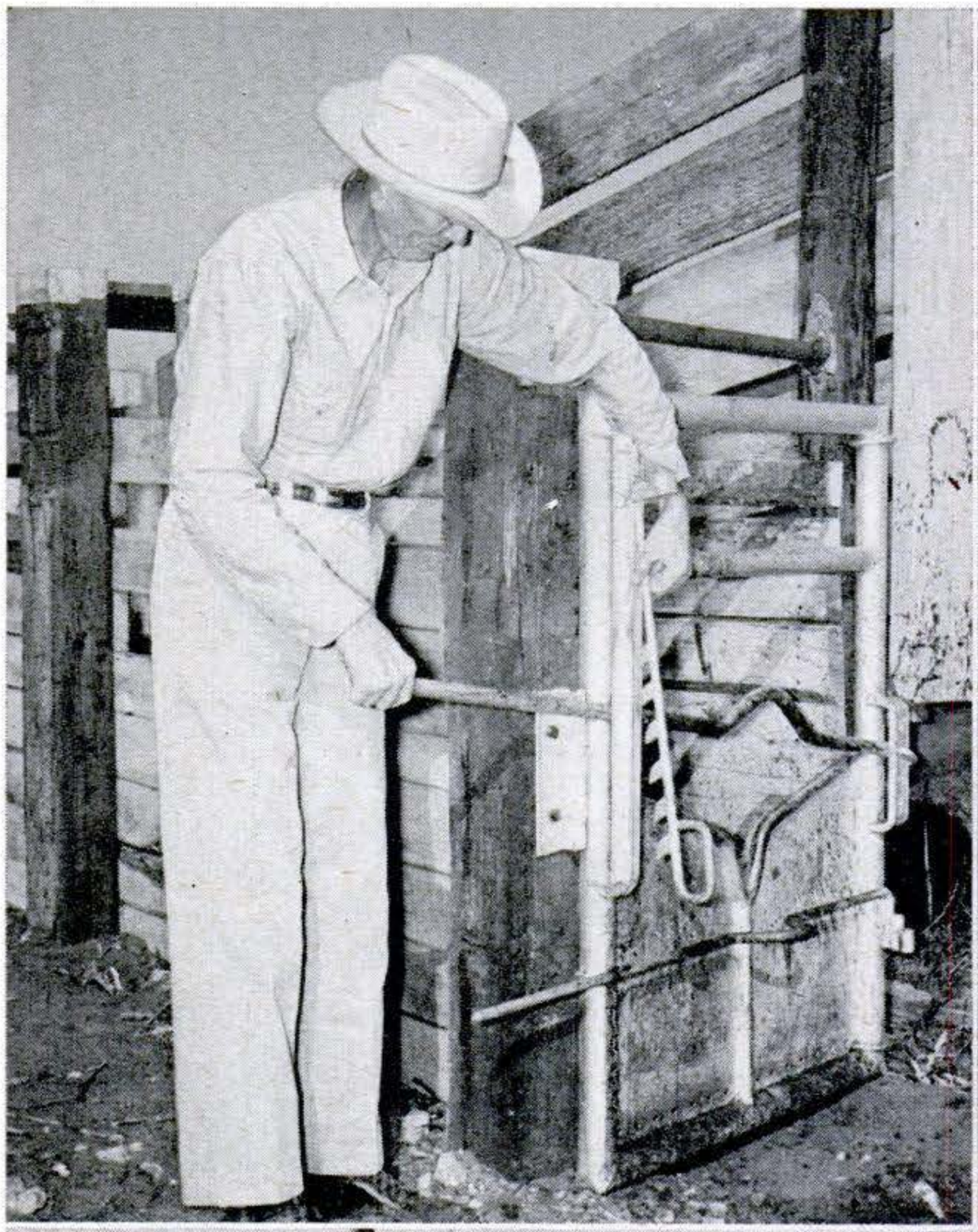
"I told him I'd try," says Crews. "They must have been all right, because he came back twice and ordered a dozen more each time."

Lately, however, he has stuck to farm equipment. His current specialty is a V-shaped aluminum stock feeder with trays that catch feed dropped by the cattle. These have proved to be much in demand. With several hundred cattle to feed, ranchers can speed up chow time. Another type of feeder consists of two metal sides, each 20 feet long. The bottom half is sheet metal, and the top is made of open frames at feeding height. Baled hay is placed between the two frames and some 28 or 30 cattle can feed at the same time.

Another unusual item he makes is an aluminum covering for a pickup truck, with a gate and partly open, barred sides for making pony transfers after a sale.

"Most metals absorb heat, and livestock

Cattle dehorning is speeded up by this welded gate device. In his right hand Crews is holding the rod that adjusts the height of the neck yoke, or clamp. The lower bar, also adjustable, fits over the nose, thus holding the animal securely while the horns are removed.



Finished side frame of a cattle feeder that is shown being welded in photo on preceding page. When completed, the feeder will have two such sides and two ends. Closed-in bottom part is for feed, open top for bossy's head. Crews' welder-assistant, Jim Holkum, is at right.

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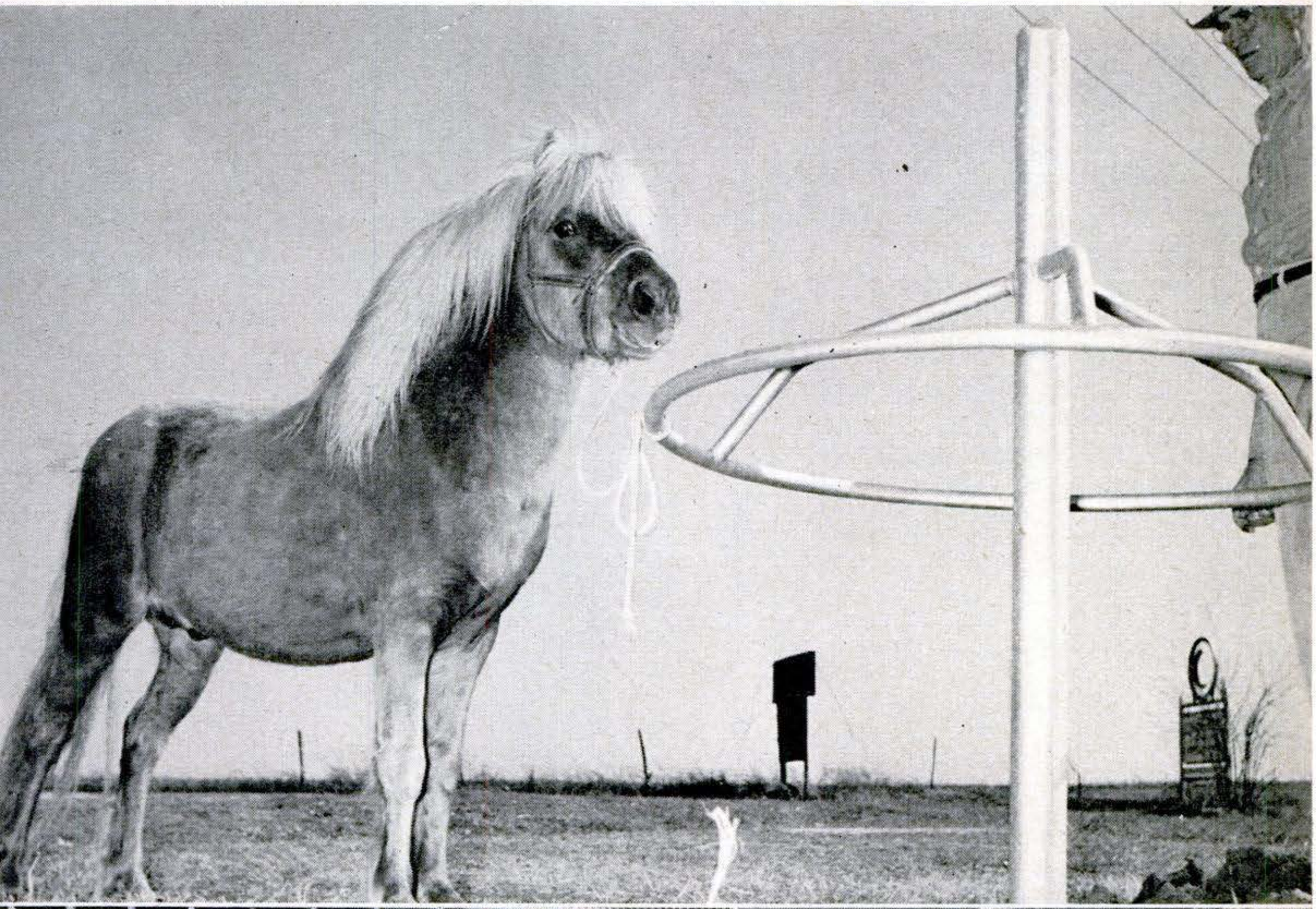
Pony tie rack is an original Crews design. A concrete-block base, buried in the ground, makes a solid anchor for the metal center post. The large aluminum hitching ring allows the pony freedom to move about a bit when a slipknot is used on the halter rope. On examining the rack, a recent visitor from Texas, a pony breeder, remarked, "I never saw one like that before." Crews chuckled and agreed, saying, "Neither did I." Before the Texan left he ordered two of the gadgets. Originality in design is the best salesman Crews has.



V-shaped feeding trough is made of aluminum, except for the side catch-all trays. These are oil drums, split down the middle, and serve to collect feed dropped by careless eaters. The feeder, 18 feet long, can accommodate about two dozen cattle without crowding.

The fighting knife Crews is holding, made of automobile-spring leaves, is called the Paul Jones, after his given names. During the war he made them for soldiers in his Oklahoma City welding shop. Locomotive-spring leaves were the raw material for his butcher's cleavers.

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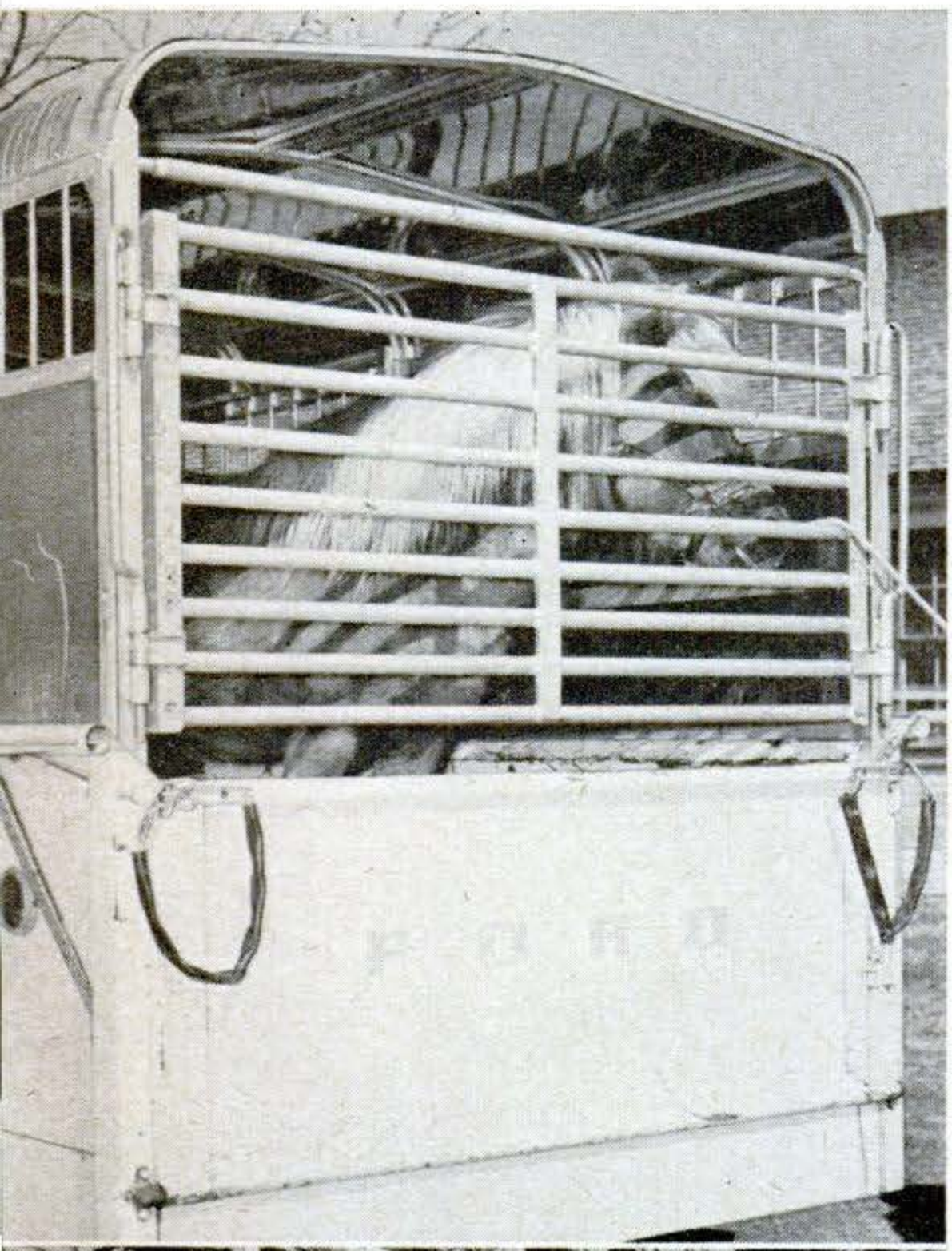
Shetland ponies travel in cool comfort under this shiny, heat-reflecting aluminum canopy designed by Crews to fit the bed of a pickup truck. The aluminum top is expensive, about $300, but then some of the ponies that he raises are worth as much as $6,000.



Children's playground equipment also comes from the farm welding shop. The teeter-totter is built for toddlers as well as for longer legs. It is easily raised to a higher rung of the ladder. The swing behind it is foot-pedal-operated by one or two youngsters.

hauled in summer in ordinary trucks are half cooked by the time they reach their destination," Crews explains. "But aluminum, which reflects heat, makes it much more comfortable inside. You can haul stock for miles under that cover and they keep cool as a cucumber."

Educated Cows Answer School Bell

Used oil drums, pipe, old sucker rods from the oil fields, any useful metal, is grist for his mill. When he needs something to work with that he can't find around, he advertises to buy it. He once advertised for 10 old school bells. Asked what for, he said that he had bought one for himself, set it out on a metal post and used it as a dinner bell for the stock.

"You can train ponies or cattle to come in when you ring the bell," he explains. "They get used to hearing the same kind of noise every day." He laughs. "I guess that's what you'd call an educated cow, if she'll answer the school bell."

Neighbors and some "drop-in" customers from Texas saw the bell and liked the idea. Crews didn't want to sell his, so he thought he'd better buy some more school bells and fix them up.

Crews just can't seem to stay out of the welding business. For years he was a welder in the Frisco Shop in Oklahoma City. He went out on his own in 1943 and opened his own shop. Then, in 1945, he decided to take up farming, bought some land and located at Fitzhugh. The next year he started breeding Shetland ponies, and now has a herd of 30.

Neighbors Put Him in Business

When he got out his welding equipment to do a few jobs for himself around the farm, neighbors came around with various tinkering jobs they needed done. It was so handy not to have to go into town for the work. The next thing he knew, the business had grown until he decided to set up a real shop. He is perfectly content whether building things on order or just carrying out whatever ideas come into his head.

He even has a neighbor weaned over into the welding trade. Jim Holkum, who farms near the Crews place, never had a welding torch in his hand until two years ago. Now he is a full-time worker in the shop, and the two of them keep busy. As long as Crews keeps cooking up ideas, it looks as if they'll stay that way. END

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Rear-View Mirror Helps Mother Keep Tabs on Sleeping Baby

ONE mother found it easy to check the covers on a sleeping baby by attaching a rear-view auto mirror to the headboard of her bed. She adjusted the mirror so she could see into the crib without getting out of bed, and placed a small night light to help her see clearly.—*Alfred I. Tooke, Los Angeles.*

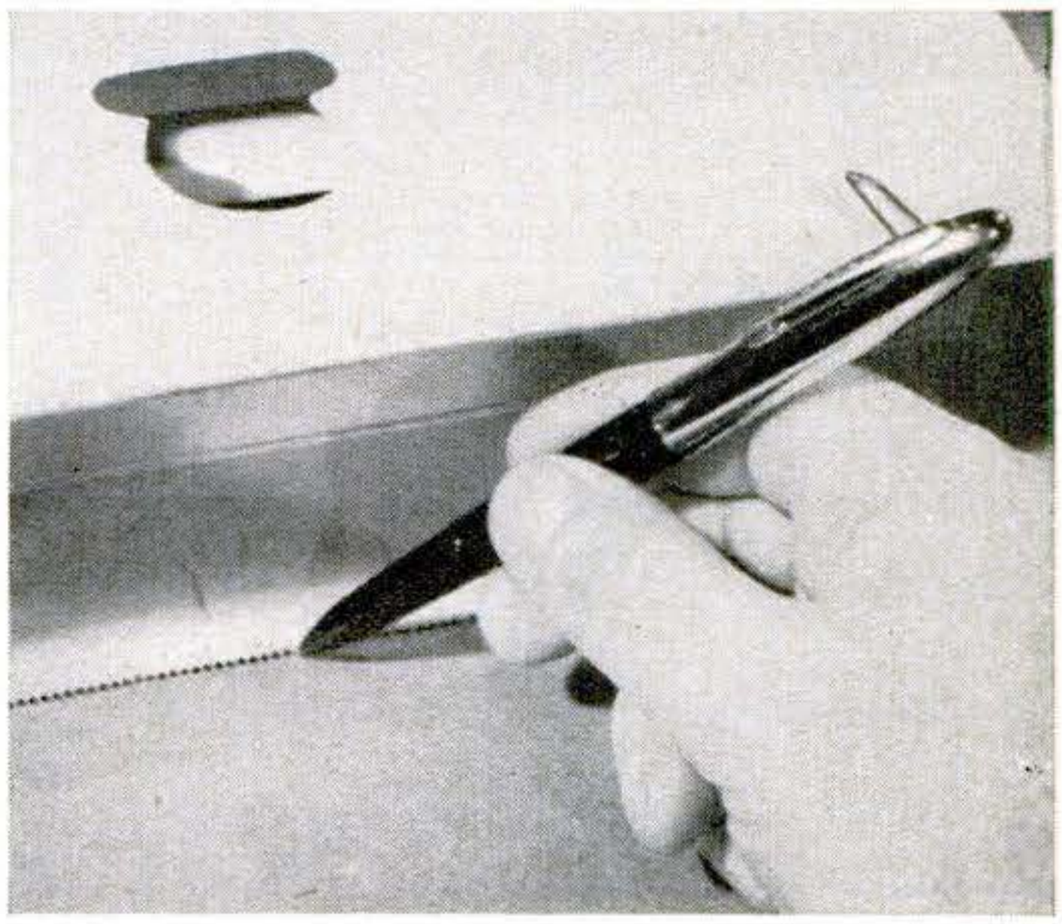
No Tipping Allowed Here

TO KEEP a dog from upsetting his food bowl, cut a hole in the bottom of a flat cardboard box like this and force in the bowl until only the rim shows.—*Glen F. Stillwell, Manhattan Beach, Calif.*

Vibration Starts Ink Flowing

IF YOU have trouble starting the ink in a ball-point-pen refill, run the point along the serrated edge of the cutter on a box of waxed paper.

This sets up vibrations in the ink chamber, settling the ink and permitting it to flow.—*Ken Murray, Colon, Mich.*



Sailor Turns Peanuts into People in Miniature-Sculpture Hobby

WHILE serving in the Navy, John Bakowski of New York City filled between-duty hours by fashioning peanuts into people and various other creatures. Finding the right shape of peanut took the longest time, he says.

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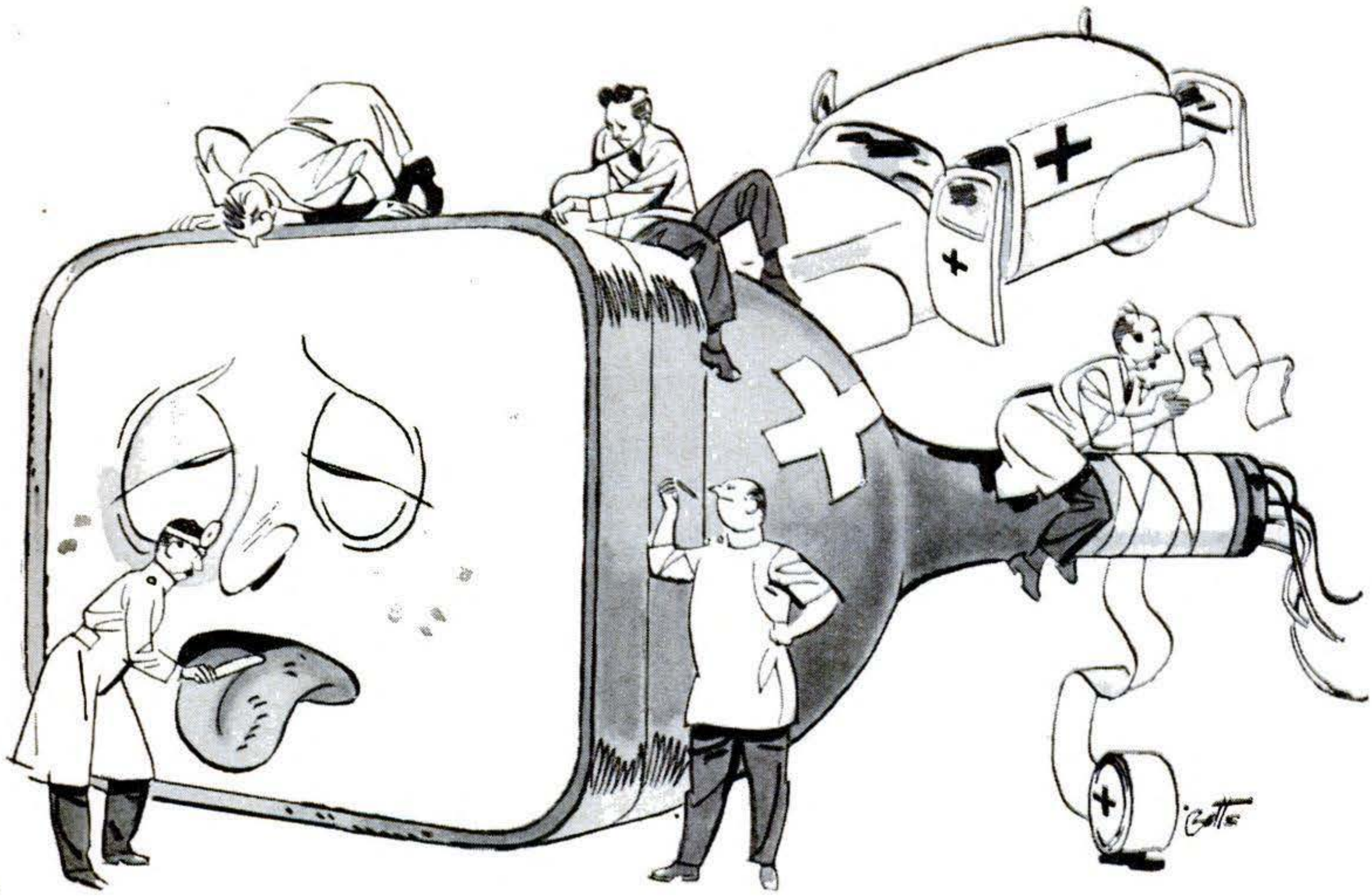

TV Picture Tubes' 5 Common Troubles

Unless Junior takes a hammer to it, your TV picture tube will expire for a predictable reason. A serviceman tells how-come.

By Art Margolis

THOSE who gaze into the TV crystal ball predict that some 4,300,000 picture tubes are going to require replacement within the next 12 months, yours possibly among them.

As a TV serviceman, I'll be called upon to haul away many of these glass corpses, and I know from experience that owners will want to know why—especially since replacements cost from $35 to $100.

A multitude of catastrophes can befall a picture tube. However, five troubles pretty well cover the field. (Of course, other troubles in the set itself can cause many of these same symptoms; don't throw out that expensive picture tube until you are sure.)

Open filaments. This is the first and most prevalent electronic affliction, and I never know where I will come across it. One day I was called to a prison. The customer was the matron.

The sound on her set was okay, but there was no brightness on the screen. Examination disclosed a bad picture tube. The reason? Open filaments.

But the matron had an "I'm from Missouri" look, so I invited her to crouch beside me while I pointed to the neck of the picture tube protruding from the rear of the set. I explained that normally there is a tiny glow in the transparent glass neck, but in

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this case the bit of illumination had been extinguished. Just as the filaments in a light bulb burn out, these filaments in the picture tube had opened up. When electricity is pumped through filaments the current makes them do two things. First, they get very hot. Second, they throw off a bright light. In a light bulb we are interested only in the light. But, in a television tube we want heat. In fact, the only job the filaments in a picture tube are required to do is to give off an intense, concentrated heat. That's why they're called the "heaters."

Low emission is another frequent picture-tube disease. I remember a case that occurred in a cheap, run-down hotel. The television set was located in the lobby.

I entered in the middle of a movie. The shades were drawn and the lobby was dark. The only light came from the TV screen—if you could stretch a point, for the cowboy actors looked as if they were galloping around in the darkest part of the Calcutta hole.

The filaments were okay in this tube. But surrounding, although not touching, the filaments is another element, the cathode. The job of the filaments is to radiate heat to the cathode. Thus the cathode becomes hot, and due to a special barium oxide coating, spits forth a beam of murderous raw electricity into the vacuum of the picture tube and on into the phosphorous coating on the picture-tube face. The phosphorus reacts by becoming agitated and glowing. We see the glow as brightness on the screen.

Now the question: why the lack of brilliance on this screen? The interior of the picture tube is supposed to be a vacuum, or as close to a vacuum as possible. However, gases collect inside the tube as a result of the electron beam bombarding the metal structures in the tube and vaporizing some of the subsequent chipped-off metals. The gases also come from small deposits of gas that are actually dissolved in the glass or metal picture-tube shell. Anyway, over a period of time these gases collect in sufficient quantity to poison the cathode and reduce its ability to shoot electrons. Also, these gases float around in the vacuum obstructing the cathode ray.

Here in the darkened lobby, the small group was watching a tube with a cathode that could not emit a strong electron beam. The electron ray barely excited the phosphors, and the coating would not take on a bright shine. Turning up the brightness control would only make the whites in the picture begin to shimmer like sparkling quicksilver and then the picture would turn inside out, like a photographic negative. A new tube was the only solution.

Open grid. One evening I was summoned by a young fellow fresh from Scotland, burr and all. I inspected his receiver and noted the symptoms: brightness but no picture.

Brightness is simply the light on the screen, but the picture comes from the various shades of black to gray to white. After the electron ray leaves the cathode and heads out into the wide-open spaces of the picture tube, the ray comes to another element in the structure of the tube, the control grid.

The lady had an "I'm from Missouri" look.

This grid governs the stream of electrons. If the voltage on the grid is strongly negative, it can exert enough force to keep a lot of the weightless electrons from getting to the phosphor screen face. On the other hand, if it is less negative, it will not be able to stop any of the electrons from speeding to their destination.

It follows then, where only a few electrons make it to the phosphor, the phosphor will be barely perturbed and glow only a tiny bit, giving a dark picture. However, if a horde of electrons swarms all over the phosphor, the phosphor will give a bright picture.

The control grid is fed with the picture information in the form of a voltage that

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"I'll watch forr a week orr two," he said.

varies with the brightness of the picture being received. This changing voltage makes the control grid either stop the electrons or let them fly in full force, causing light spots and dark spots on the phosphor screen face. These add up to the television picture that you see.

This hapless tube had a busted control grid. With the open grid, there'd be no "Lucy," even though there was plenty of brightness on the screen.

My Scottish customer was taken aback at the disturbing news, but after making sure of the price he gave me the job. He watched me closely while I installed the new tube. As I was leaving he said, "I want to give you something extra forr yourrself. I think you do verra good work, so I will watch the television forr a week orr two and if it plays well, I'll call you on the telephone and you may stop back for the tip."

Fixed brightness. This comes from an internal short in the electron gun, the term designating all of the elements in the picture tube: filaments, cathode and control grid, plus one more element, the accelerator.

The gun operates like this: The filaments heat up the cathode; the cathode, when hot, gives off an electron-cathode ray; the ray reaches the grid; and the grid inserts the television picture information into the ray. At that point, the accelerator takes the cathode ray and accelerates, or shoves, it out into the picture-tube vacuum. Fixed brightness occurs when any or all of these four elements physically touch each other.

In addition, there are bright horizontal lines through the picture which remain uninfluenced by the brightness control. Turn the control all the way up or all the way down—the picture remains at a constant-brilliance level. Remedy: a new tube.

Open cathode. I come across lots of old acquaintances and friends in my TV service travels. One customer, a lady, turned out to be an old Junior High School science teacher of mine.

I turned on the set and noted that there was no brightness at all. The filaments of the picture tube were lit, so I checked to see if any high voltage was being produced by the set. When the electrons leave the electron gun, they are shot towards the phosphor screen face. But they would never complete the journey with enough energy if it weren't for the high voltage. Between 10,000 and 15,000 volts is applied to the outer shell of the picture tube, and this has the ability to suck the electrons violently toward the screen face and dash them against the phosphors.

There was plenty of high voltage here, but there still wasn't any brightness on the screen. I discovered that the internal connection to the cathode of the picture tube was cracked open and would not allow the picture tube to accept the high voltage the set was producing. For the picture tube to be able to accept the high voltage, a complete circuit must be made between the cathode and the shell of the tube. With an open cathode, the circuit was broken of course.

I stood up and informed my old schoolmarm that her TV set had a bad picture tube. Then she, using the same inquisitorial tones I remembered from eighth grade, asked me why.

A few days later I received my check. In the envelope was something else—a report card with my name and one subject typed neatly on it. The subject: "TV Service." The grade: "A."

Unlike school days, I was prepared.

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Ink Stains Filler to Order

COLORED waterproof drawing inks, available at art-supply stores, will stain natural-color plastic composition wood to match the surrounding woods.

A wide range of shades can be obtained by mixing brown, yellow, red and black inks in different proportions. Apply with a soft brush after the composition wood has hardened and been sanded.

Lock "Kid-Proofs" Appliances

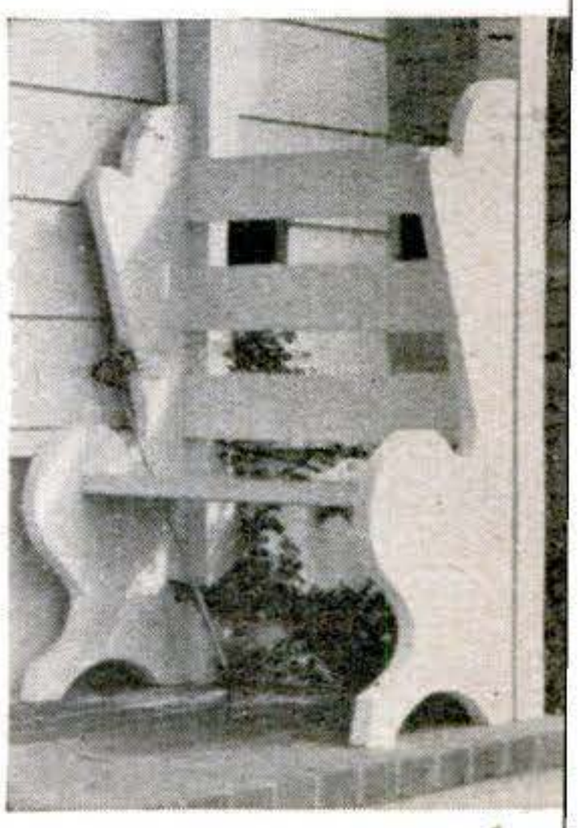
INQUISITIVE youngsters can't plug in a tool or appliance if you slip the shackle of a miniature padlock through one of the holes found in the prongs of practically all male electric plugs. Padlocks of this size are generally used for dog collars and mailboxes.—*Sid Corlin, Chicago.*

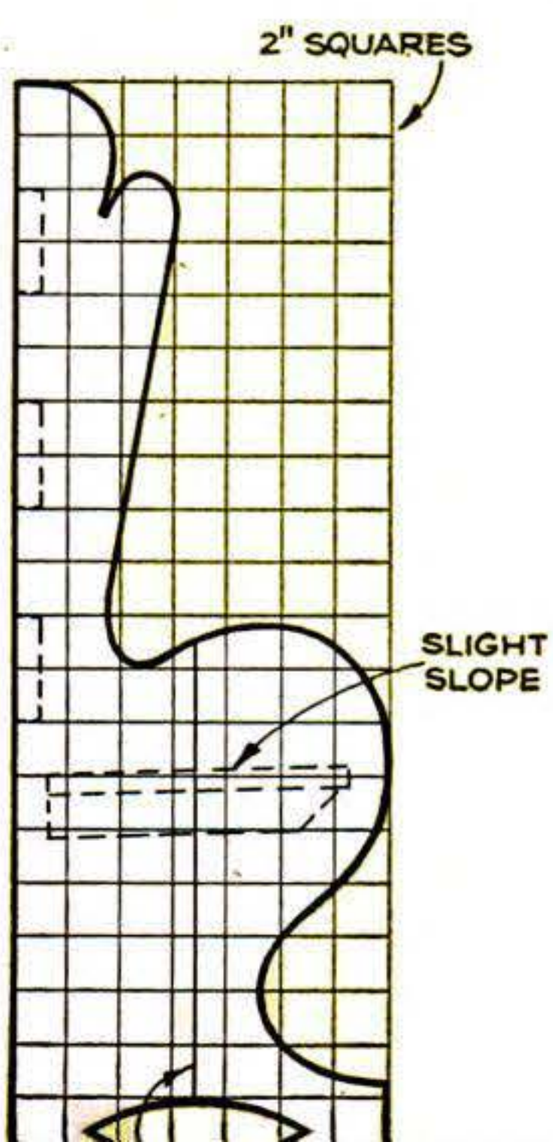
Dutch Seat Provides a Dressy Touch for a Small Porch

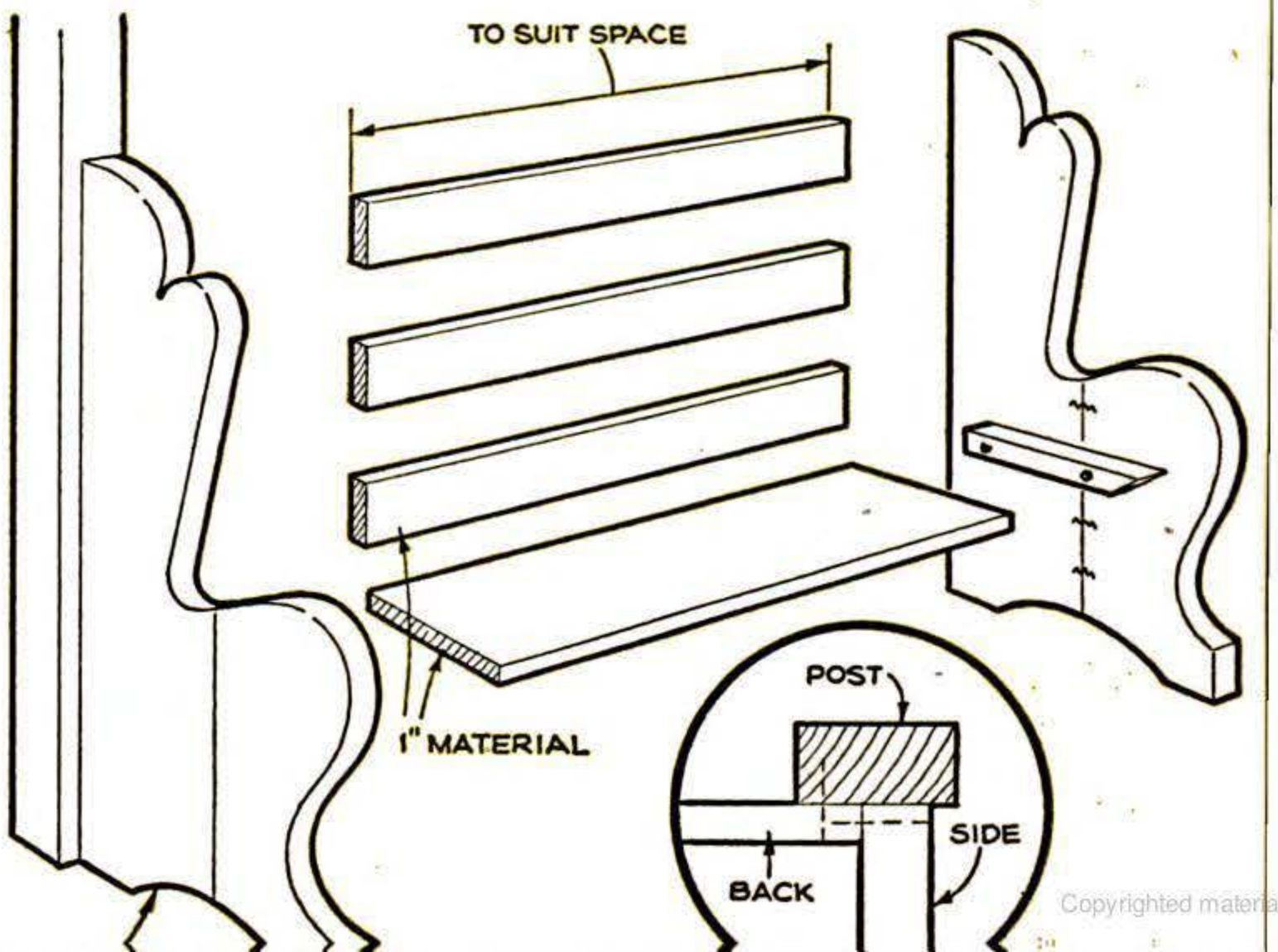
THOUGH it may never be used for lounging, this attractive Dutch seat will make your front porch look warm and inviting.

Lay out the profile of the sides on a sheet of wrapping paper ruled into 2″ squares and transfer the pattern to the wood. Use two pieces of two-by-eight glued and fastened together with corrugated nails to make the board width needed for each side. Nail the seat to cleats screwed to the sides and nail three one-by-four strips in place for the back rest. Note that the cleats are attached so that the seat slopes slightly to the rear.

Make the seat about 30″ wide if it is self-supporting, otherwise make it wide enough to fit between the porch posts, which will brace it and give it the appearance of a built-in unit. Paint it to match the trim of the house.—*Hi Sibley, Nuevo, Calif.*







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How to Build a Tesla Coil

Want to see just how crazy high voltage can get? This rig will do some fascinating tricks for you.

By Elbert Robberson

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JACOB'S LADDER. Electric flames snarl up two diverging wires just as they do in horror movies. One wire can be hand-held, but don't touch the sparking part, which gets hot. In this time exposure, one spark looks like a series; the eye sees a single one moving up.

ELECTRIC PINWHEEL. An S-shaped piece of wire pivoted on the terminal so that it can spin freely forms a circle of sparks. The pinwheel is driven by an "electric wind."

WILD VOLTAGE. Tearing at its barriers, high-frequency voltage provides fireworks as it leaps out from a ball of steel wool.

HAVE you ever let 50,000 volts jump through you?

Or seen electric flames climb a wire?

Or made a fluorescent lamp glow by holding it in your hands?

Or built an electric jet motor?

These stunts are a cinch if there is a Tesla coil in the house. One that you can build in a few evenings will do many of the tricks of a million-volt laboratory on a miniature scale.

Nikola Tesla invented the high-voltage, high-frequency transformer about the turn of the century with the idea of broadcasting electric power. It worked. From a 200-foot-high transmitter in Colorado Springs he lit lamps over a wide area without wires. But since power was radiated in all directions, most of it was wasted. The Tesla coil went back to the laboratory.

With the age of electronics and nuclear research, cyclotrons, oscilloscopes and other inventions called for just the high-voltage radio frequencies Tesla's rig generated. The Tesla coil came off the shelf, put on working duds, and among other things took a job on television.

The Tesla coil works on the familiar transformer principle—an alternating current in one coil of wire induces a voltage in another coil insulated from but in magnetic coupling with it. A transformer can step voltage up or down. The kind used for toy trains or doorbells steps 115 volts from

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the house mains down to a safe 6 to 20 volts. The spark coil in a car—also a transformer—steps battery or generator voltage up to 20,000 or 30,000 so that it will jump the spark-plug gaps.

Voltage gets a big boost. The voltage change is in proportion to the ratio between turns of the input (primary) and output (secondary) windings of the transformer. A Tesla coil has a primary of a few turns of heavy wire, and a secondary of many turns of fine wire.

But what is fed into its primary isn't ordinary AC by a long shot. In the coil shown, for instance, household juice is first boosted to 1,500 volts by an ordinary radio plate-supply transformer. Then this is converted by a one-tube oscillator to a 475 kilocycle frequency (just off the long-wave end of your radio dial). That's what goes into the Tesla primary.

What appears on the secondary seems out of this world. You can't fence it in; it jumps off any edge or point as a fiery brush. Spectacular in appearance, this corona can create enough heat to melt metal and, if concentrated on a sharp point, generates an air blast strong enough to spin a light wheel or blow a candle flame.

It has two other weird properties—skin effect, and radiation. Household current strikes right through the human body. But Tesla currents oscillate (reverse themselves) so fast that they travel only on the surface of conductors. They go only skin deep; you don't feel a thing.

Such fast oscillations also radiate into space. They can be detected by a receiver tuned to their frequency, and will light neon or fluorescent lamps feet away. Some of these effects are shown in the photos.

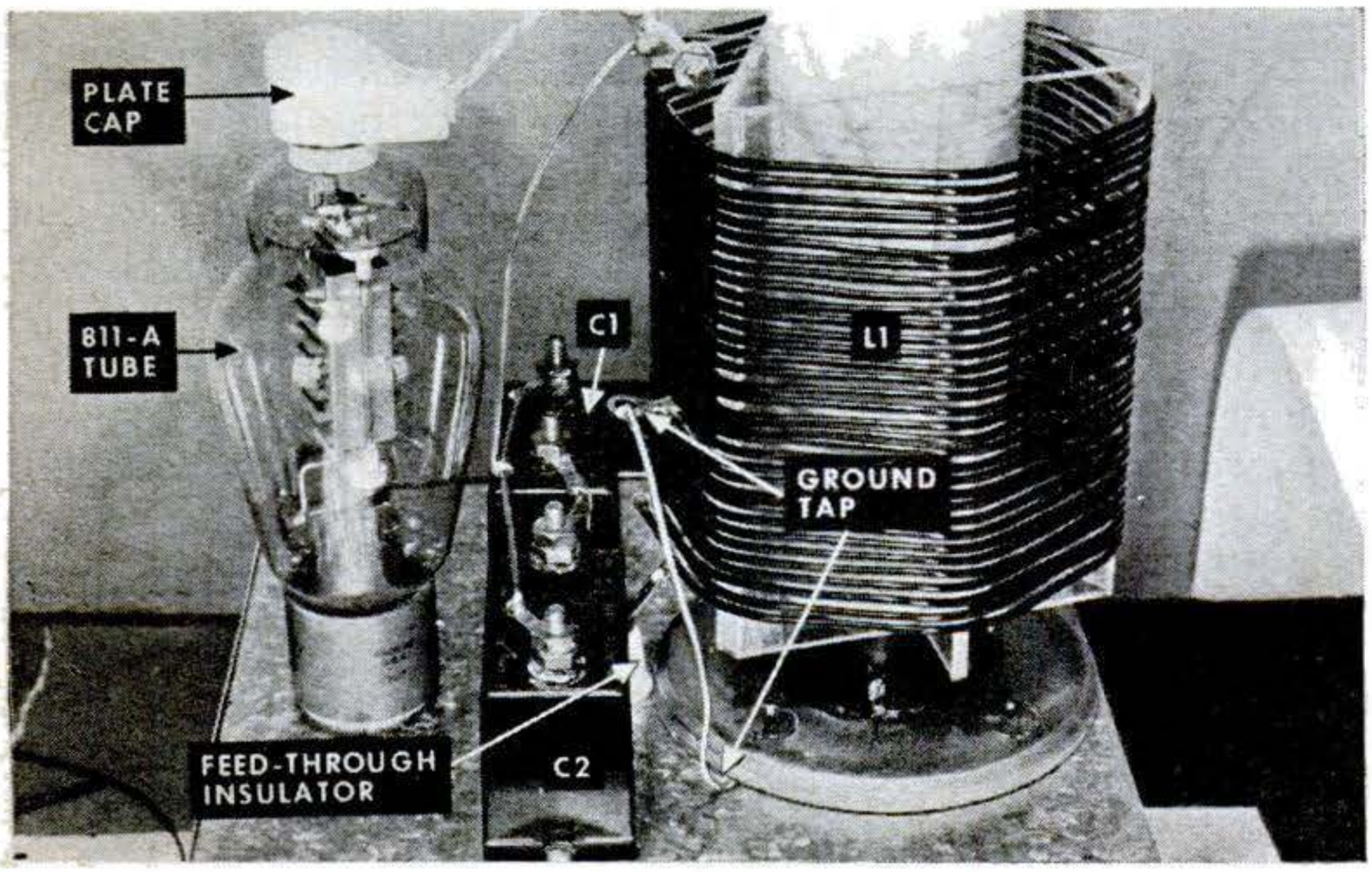
Ordinary bench tools are all you need to build the Tesla coil shown. The outfit con-

ELECTRICAL PARTS LIST
(refer to circuit diagram for symbols)

L1: RF transformer primary (see text)
L2: RF transformer secondary (see text)
C1: 700 mmfd., 5,000-peak-volt mica capacitor, Sprague 2MC or equal
C2: same as C1
C3: 500 mmfd., 5,000-peak-volt ceramic or mica
C4: 5,000 mmfd., 5,000-peak-volt mica capacitor, Sprague 2MC or equal
R1: 2,500-ohm 20-watt wire-wound resistor
T1: 6.3-volt, 4-ampere, 2,500-volt insulated filament transformer, 115-volt primary, Stancor P-4019 or equal
T2: 750-0-750 volt 250 m.a. plate transformer, 115-volt primary, Stancor PC-8034 or equal
S1, S2: SPST toggle switch
V1: 811-A vacuum tube
1 ceramic feed-through insulator, ICA #2305 or equal

HARDWARE LIST

½ lb. #32 cotton-enamel insulated magnet wire
50′ #12 enameled copper wire
1 4-pin tube socket, Amphenol 49-RSS4
1 9/16″ plate cap, Millen #55001 or equal
1 alligator clip, ICA #884 or equal
25′ #16 stranded hookup wire insulated for at least 2,000 volts
15′ 2-conductor "zip" cord
1 2-pole line plug
30″ length of Bakelite 1/16″ wall tubing, 2″ outside diameter, Insuline or equal
1 pc Plexiglas 5½″ by 14″ by ⅛″ thick
1 oz. cement for Plexiglas
1 pc 22-gauge galvanized steel or aluminum 24″ by 24″, or box about 7″ by 8″ by 8″
Miscellaneous: lugs, screws, nuts and sheet-metal screws, metallic household cement or cold auto-body solder, plywood, 2″ funnel



TOP-DECK WIRING shows the ground tap of the Tesla primary soldered to a lug that is clamped under one flange-mounting screw. The outside terminals of C1 and C2 are joined by a jumper and connected to the upper terminal of L1. Inside terminals are also connected and go to the feed-through insulator and bottom terminal of L1. Use No. 16 stranded flexible wire for the tube-plate cap, cutting it just long enough to reach without stretching. See text for how to "fire up."

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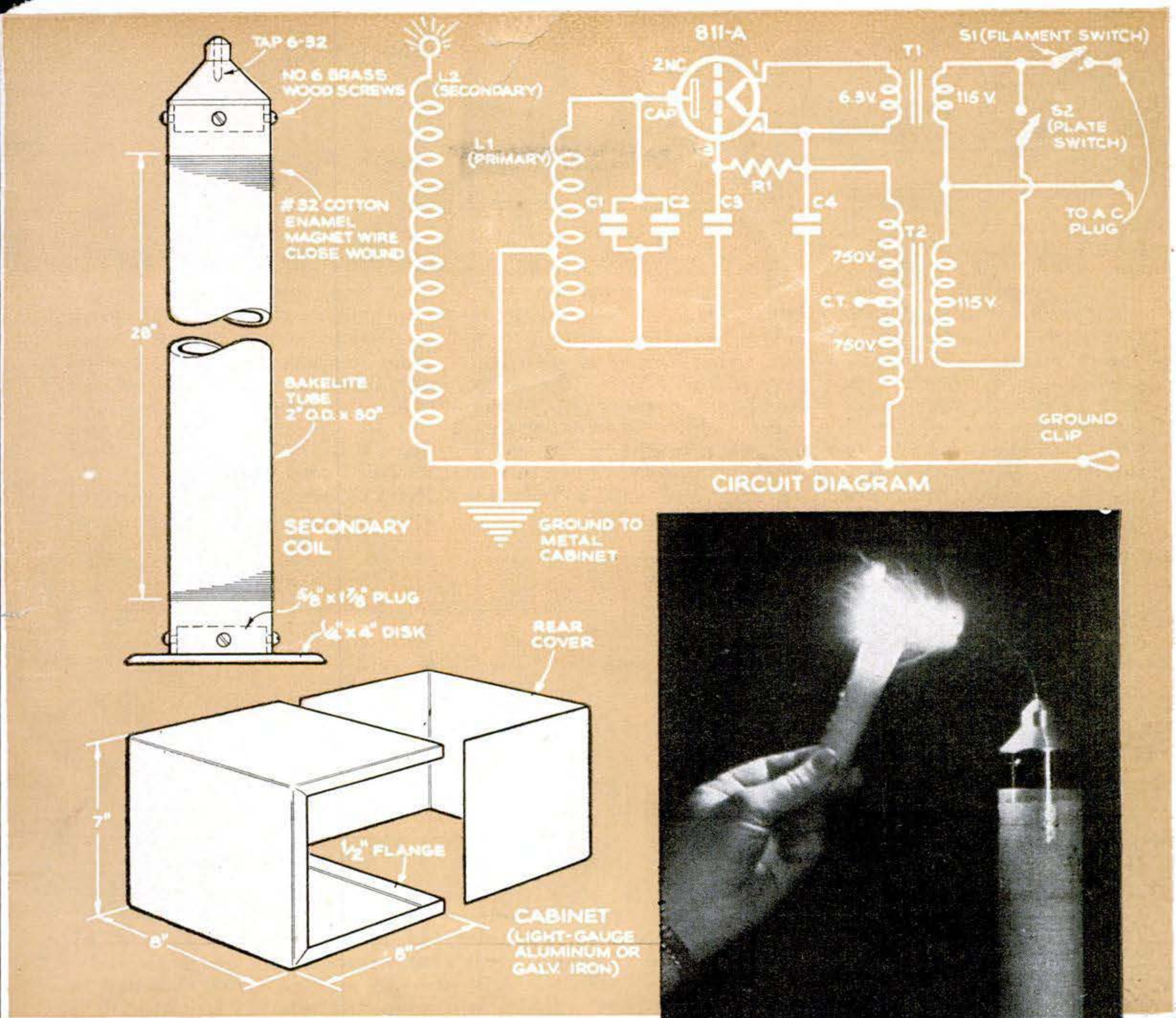

ELECTRIC WIND. **On a sharp point, charge density is so great that it electrifies air before it. The effect is that of a strong air jet, shown blowing a candle flame.**

sists of a homemade radio-frequency transformer, a vacuum-tube oscillator, and two ordinary radio power transformers for plate and filament supply. Parts are available from any amateur radio or experimenter's supply house, although the 30″ length of Bakelite tubing may have to be ordered. You can save money by shopping for surplus or using scrap-box parts, but stick to the ratings and values given.

Safety is built in. Although Tesla current is harmless, the intermediate power supply can dish out a nasty jolt. Therefore the rig is designed so that exposed parts are either grounded or carry only radio frequency, which may cause a slight burn but cannot shock.

The transformers and other "hot" parts are mounted inside a sheet-metal box. You can make this from galvanized iron or sheet aluminum by bending it up as in the drawing, or use stock cabinet of similar size.

Because radio frequencies call for special handling, all top-deck wiring should be No. 12 solid copper, well-soldered at connections, and kept as short as possible. Use lugs to connect wires to terminals. The inside wiring should be No. 16 gauge or heavier, with rubber or plastic-and-fabric insulation rated for at least 2,000 volts.

Brand names are given in the parts list as a help to identification. These happen to be the parts I used, but any make of equivalent quality will do.

[*Text continued on page 196*]

Please turn the page for construction photos.

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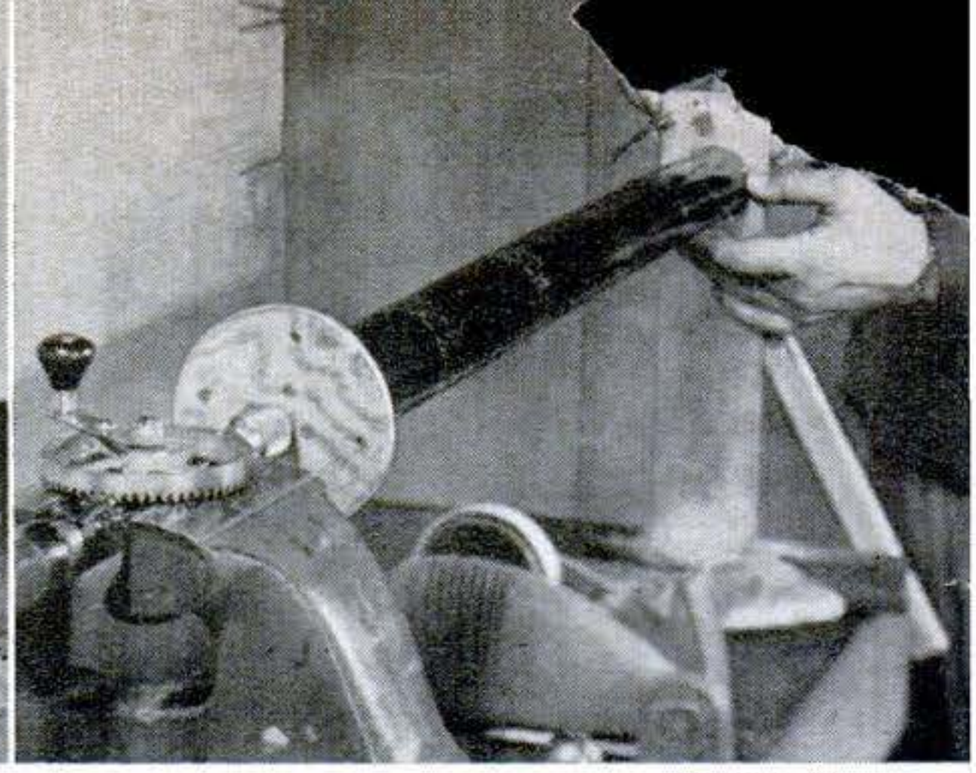
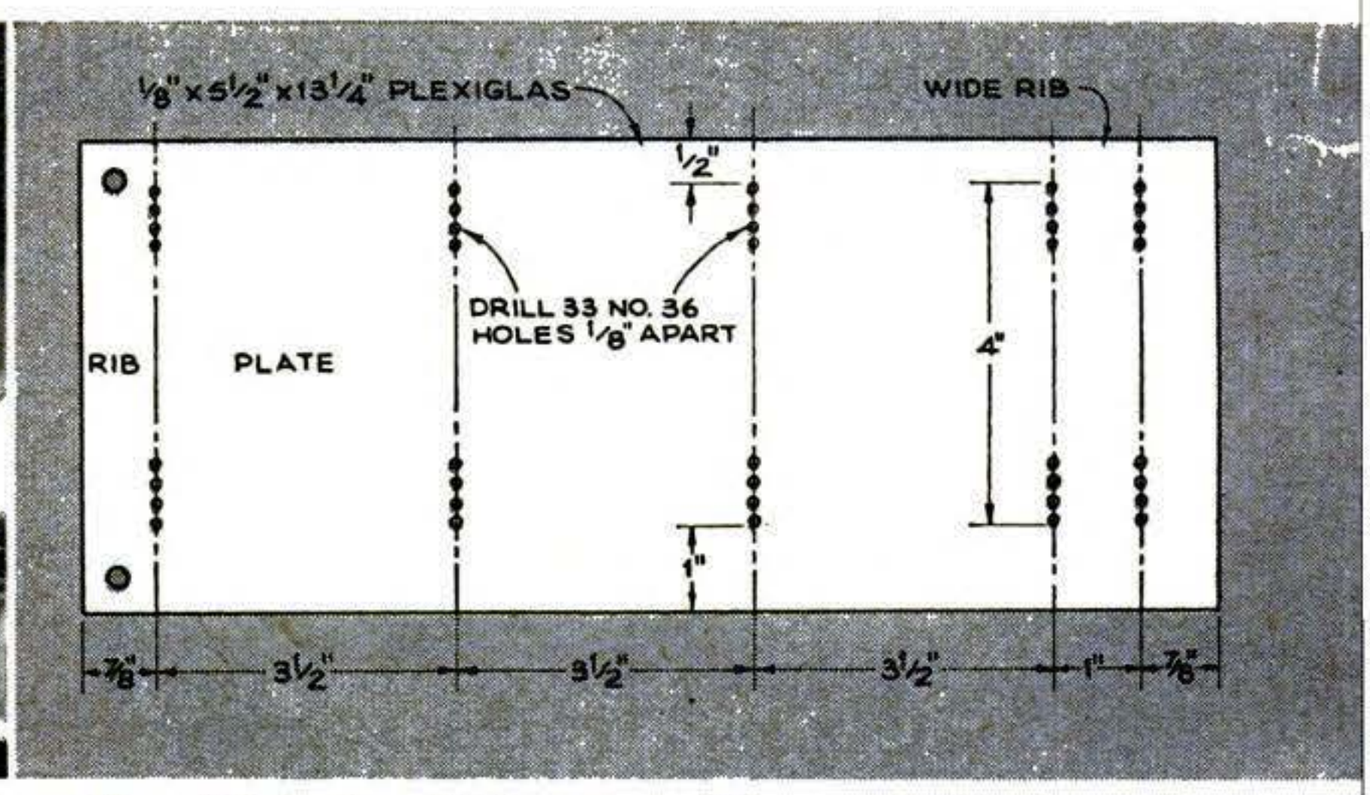
1. CUT TWO PLUGS from thick plywood to fit tightly inside the Bakelite tube. Saw a 4″ disk of thinner plywood and attach one plug to it with four wood screws from beneath. Drill and countersink four mounting holes in the disk. Shellac wooden parts before fastening to tube.

2. FOR YOUR WINDING MACHINE, clamp a hand drill in a vise, parallel to the bench top, using blocks to give the jaws a firm grip on the drill. Bend up a piece of heavy sheet metal as shown (or fasten an upright piece to a block of wood). Chuck a No. 25 drill and drill a hole in the upright like this.



3. CLAMP THE UPRIGHT 30½″ from the end of the drill chuck and in line with it. Clamp a brace from upright to bench. Fasten one plug into each end of the tube with small wood screws. In the center of the base flange, drive a 2″ No. 14 screw. Cut off its head and chuck the shank. Drive a screw through upright into center of the other plug.

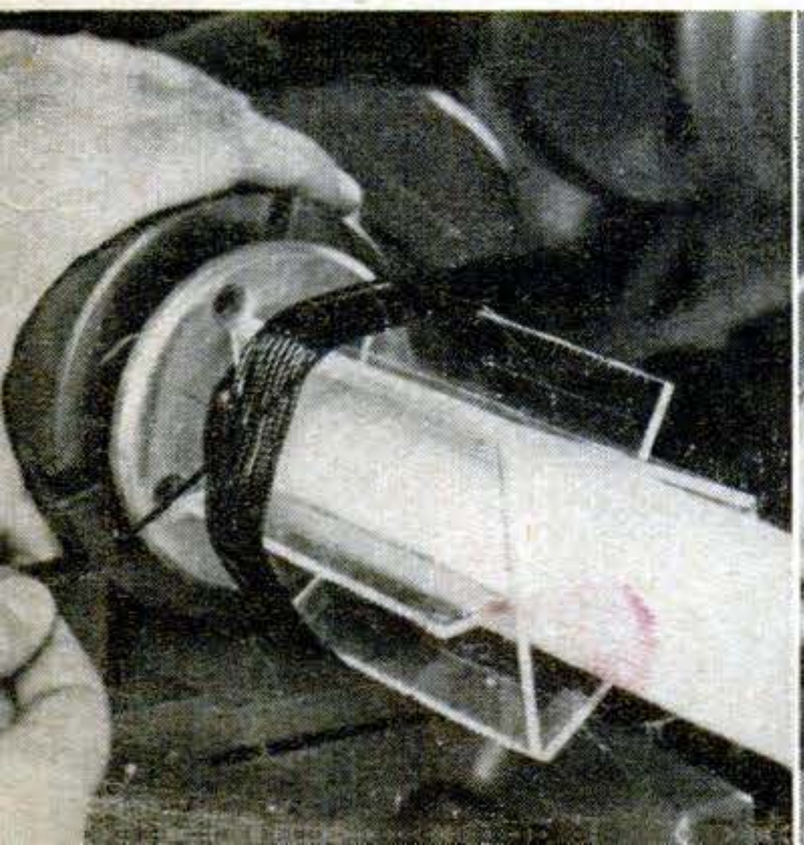


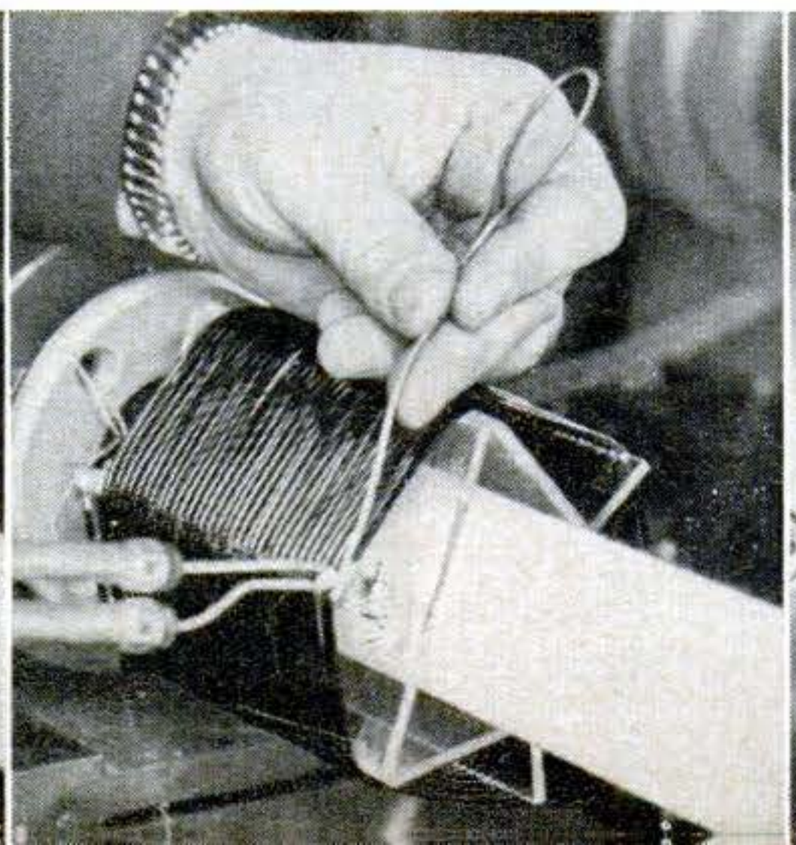
7. BUILD A FORM from three plastic plates and three ribs, having notches to wind the wire of the primary coil. Lay out the parts as shown in the drawing (right, above), making the inside rib 1″ wide, and the two outside ones only ⅞″ wide. Carefully mark the No. 36 holes ⅛″ apart. If you drill them by hand, lightly center-punch each one accurately. On the drill press, a wooden fence clamped to the table, with a locating pin ⅛″ from the drill point, can be used as a guide. Run the drill fast but feed down slowly so as not to chip the plastic.

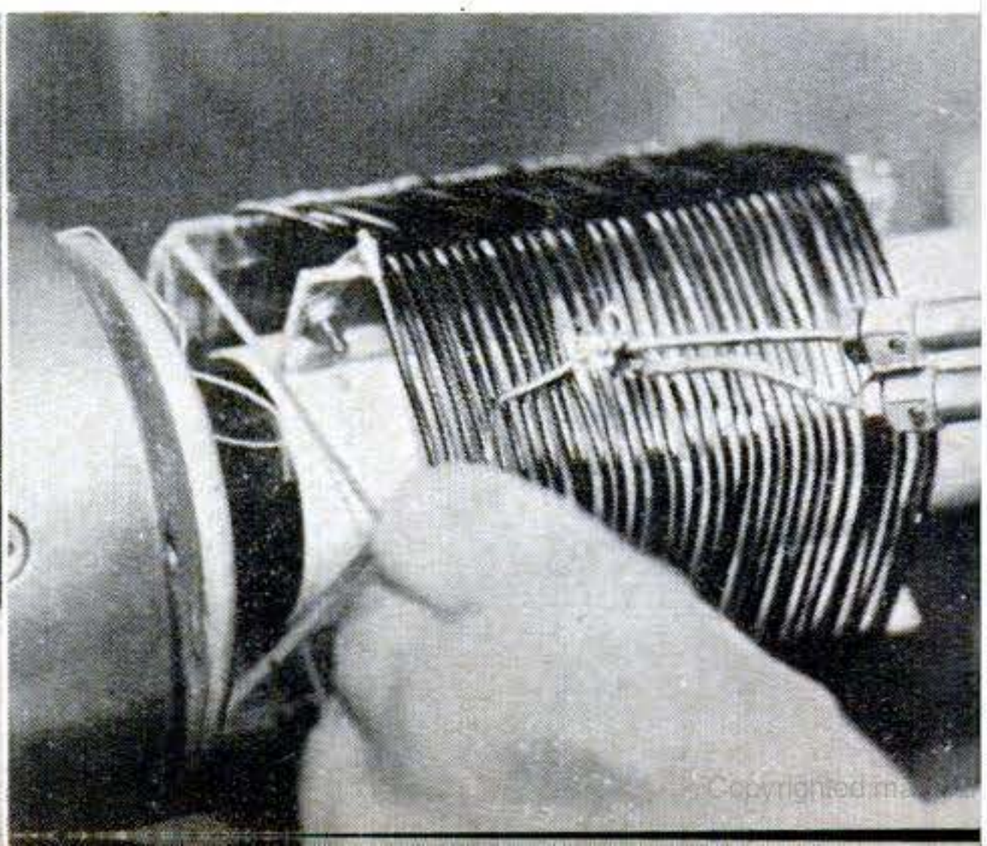
10. REMOVE THE TAPE, solder one end of the No. 12 wire to a lug and fasten it under the lower terminal screw. Then turn the base flange by hand to wind on the primary in the same direction as you did the secondary, laying one turn of the heavy wire into each of the 33 notches all around.

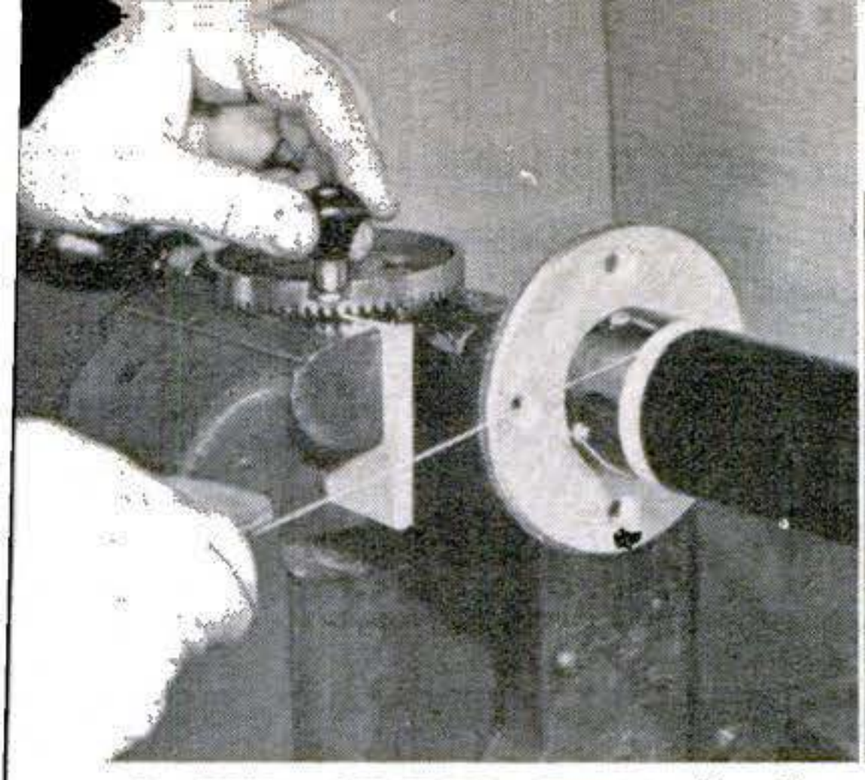
11. SOLDER THE END of the last lug to the top terminal lug. Use a hot iron, make the joint as quickly as possible, and clap a damp rag onto it to reharden the plastic, which will have softened from the heat. Now apply more cement along all the plate and rib edges to set the wire turns, making certain that each is in its own notch.

12. SCRAPE THE INSULATION off the eleventh turn from the bottom of the coil. A narrow strip of sandpaper pulled between both hands will get under the wire. Push apart adjacent turns a bit if necessary. Then loop the tail of a lug around the bare wire, solder it to this bared turn, and push the spread turns back. The finished transformer can now be removed.

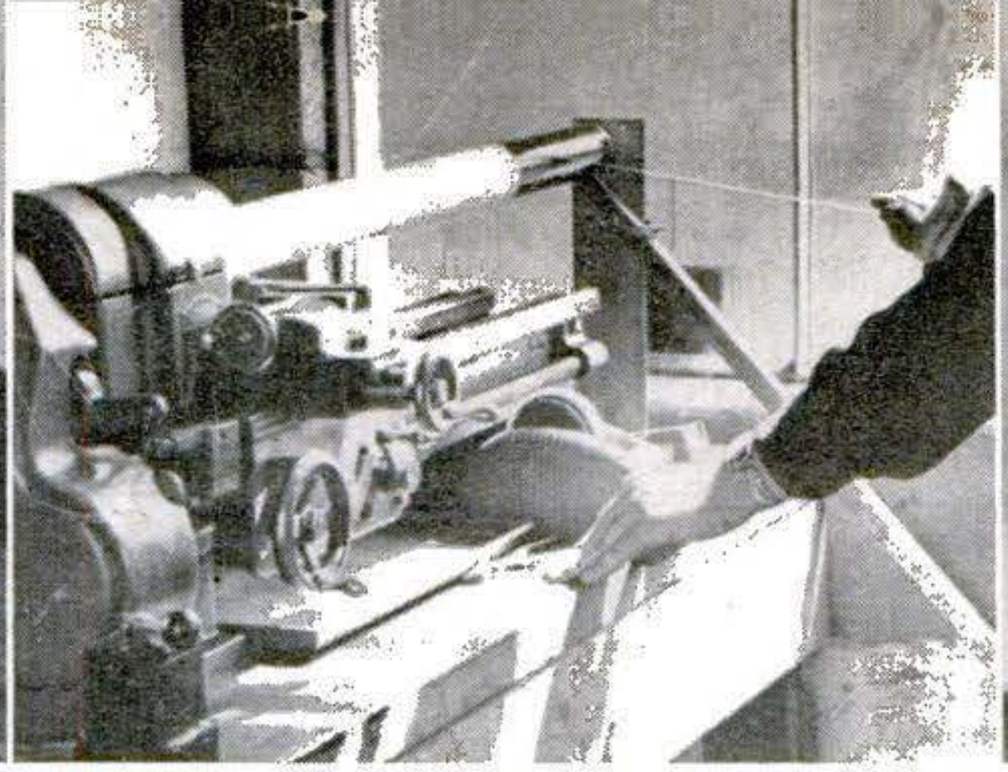




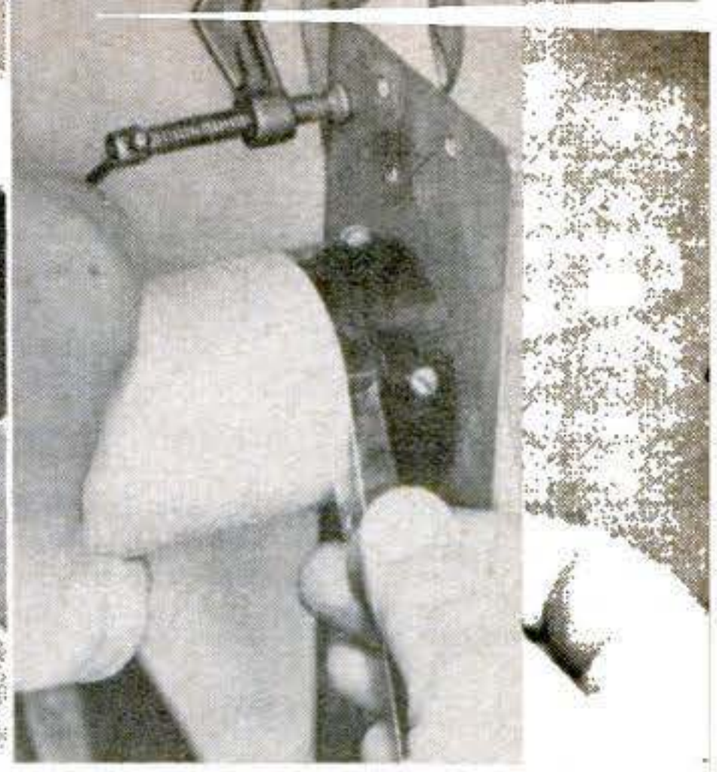




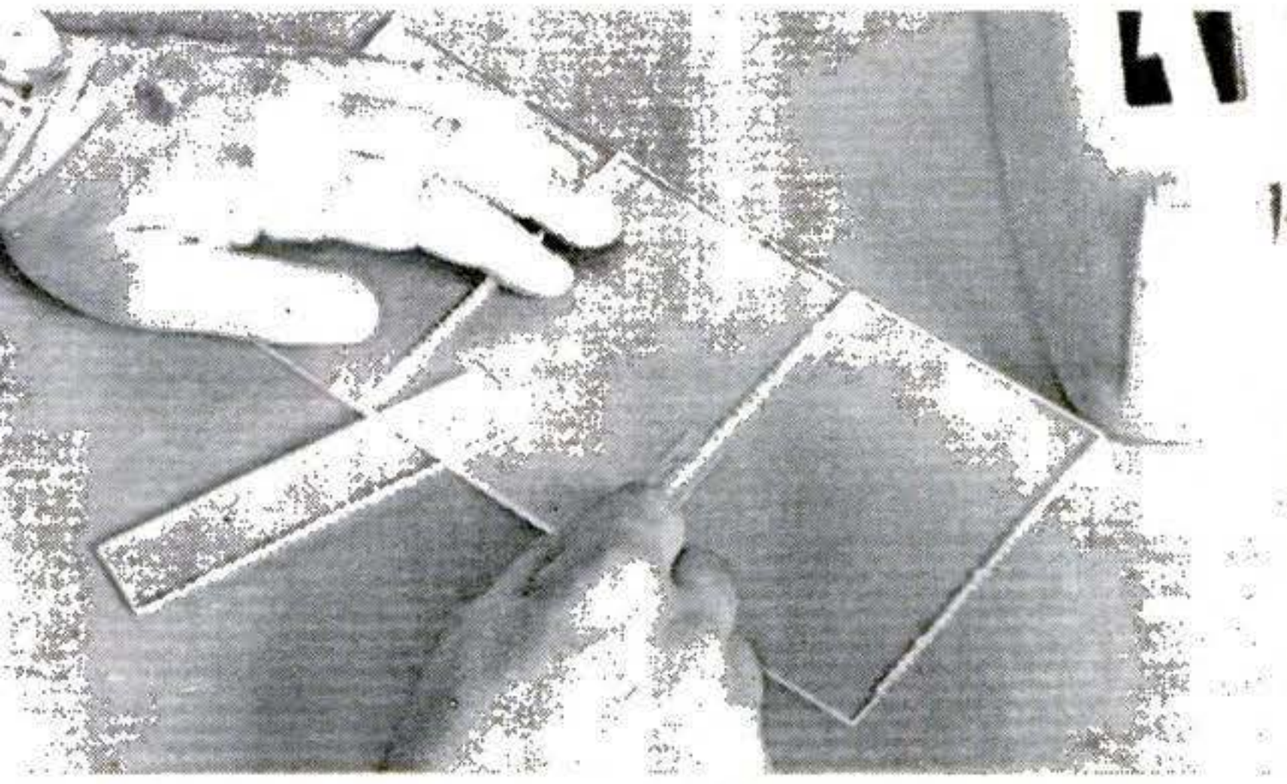
4. TUBE SHOULD TURN freely and run true if centers are well located. An inch from the base, tape the end of the No. 32 wire securely and wind on a few turns, evenly and without overlap. Then mount the spool of wire on a dowel clamped within easy reach. Put a heavy glove on the hand that will feed the wire.



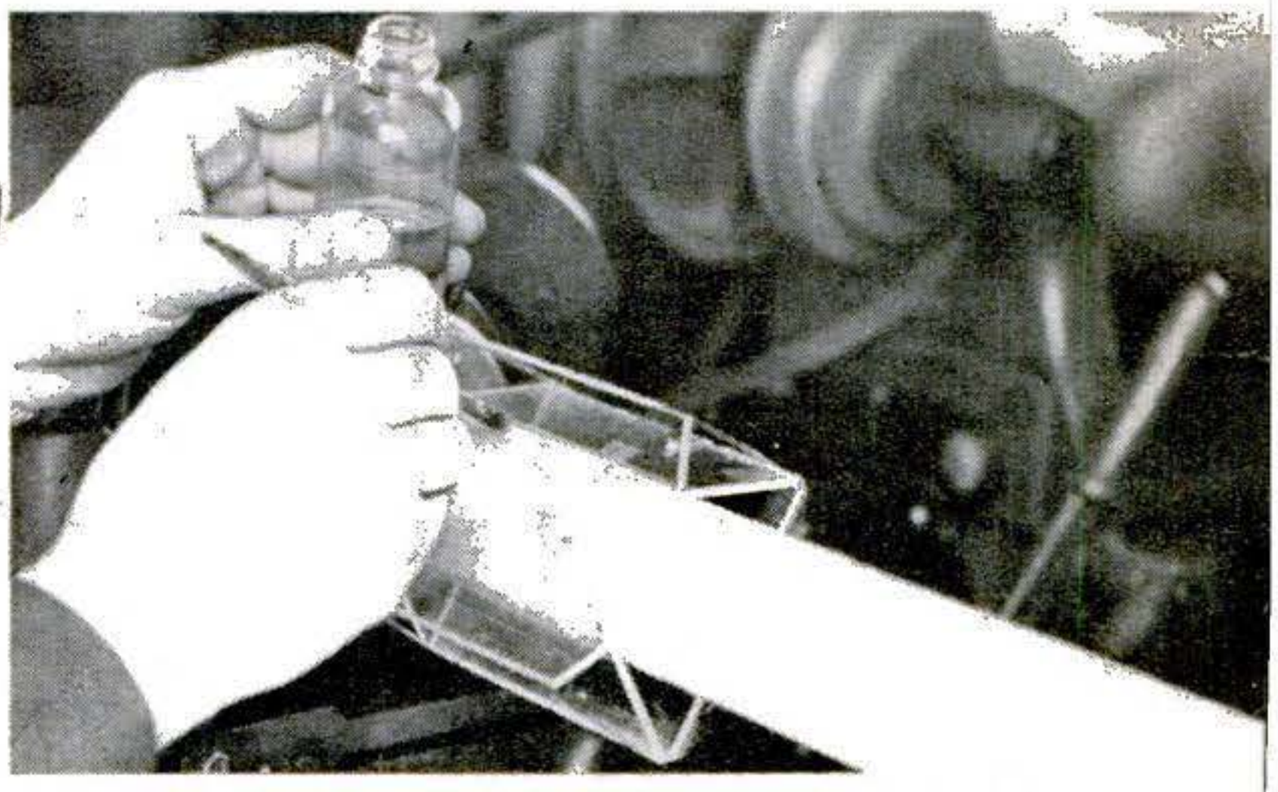
5. IF YOU HAVE A LATHE, you can wind with power. Use back gears to get about 150 r.p.m. Keep your hand well back from the tube as shown, angling it about 5° behind the winding point. If the wire overlaps or leaves a gap, go back and rewind it evenly. Apply just enough drag to keep the wire taut; avoid jerks that may snap it. The supply reel is best mounted several feet behind you.



6. AFTER WINDING 28″ of coil, secure the wire with tape. Solder the coil end to a lug secured under one of the wood screws holding top plug. This completes the secondary coil, but do not remove it from winding rig.



8. WITH A THIN-BLADED SAW, cut ribs and plates apart through the centerline of the holes, which will leave notches along 4″ of the cut edges. The wide rib will have notches on both edges, so cut off one edge to make it the same width as the others. Hinge plates together with tape.

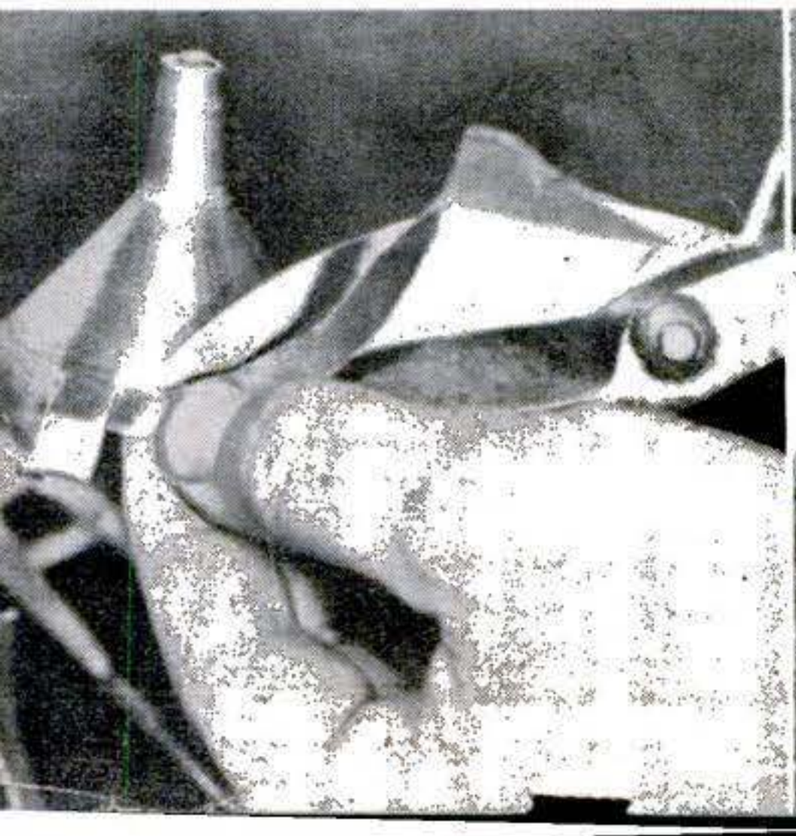


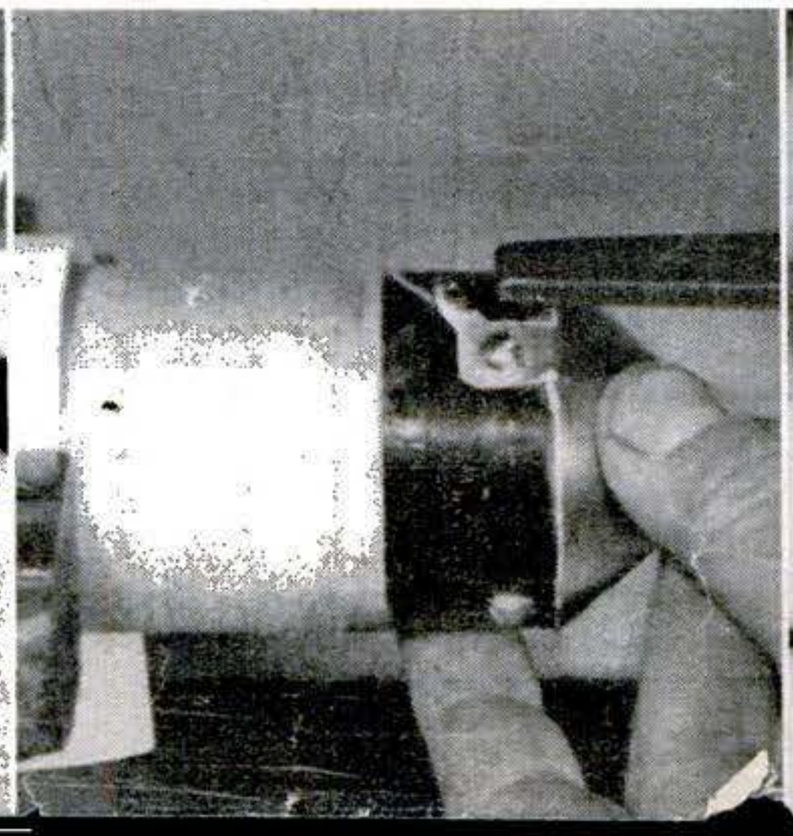
9. WRAP THE PLATES around the secondary with notches for first primary turn 1″ above bottom of the secondary. Tape the corners; then apply plastic cement to edges. Center the ribs on the plates and cement edges, being careful that all notches line up.

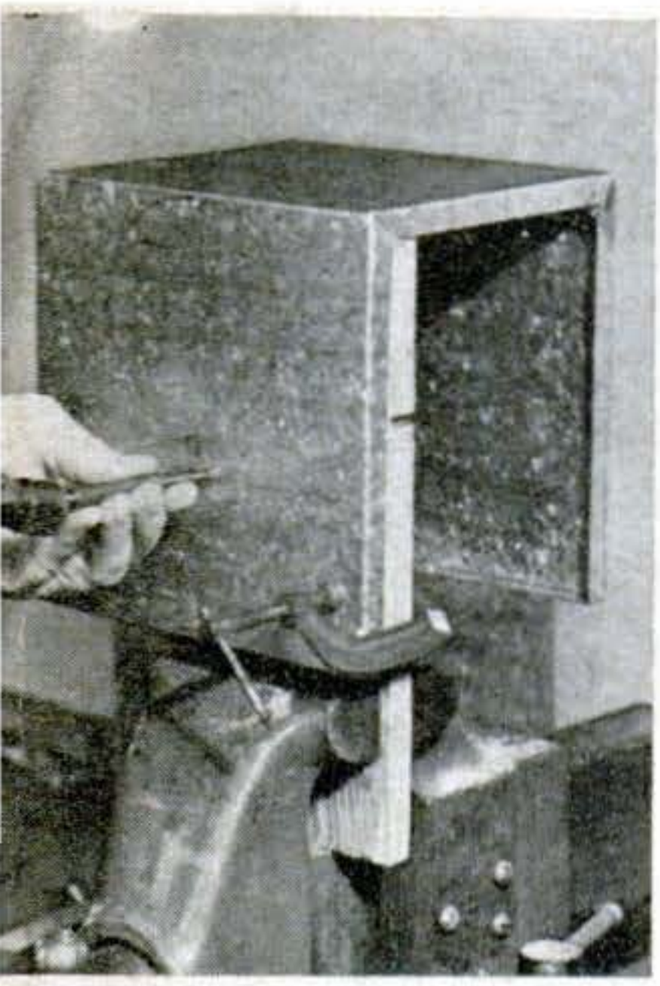
13. ALUMINUM FUNNEL forms the secondary cap. Lay it on a flat surface and scribe around it at a diameter of 2″. Mark off a ½″-wide connecting tab. Trim off the rolled edge except at the tab. Then cut exactly on the line. File off any slivers in order to leave the edge as smooth as possible.

14. CUT THE NECK of the funnel to ½″ in length. Drive in a dowel and hammer the neck over it to a rounded tip, leaving a 1/16″ hole in the center. Attach the cap with aluminum cement or body solder, with its tab under the secondary terminal screw. File edges smooth to reduce corona leakage.

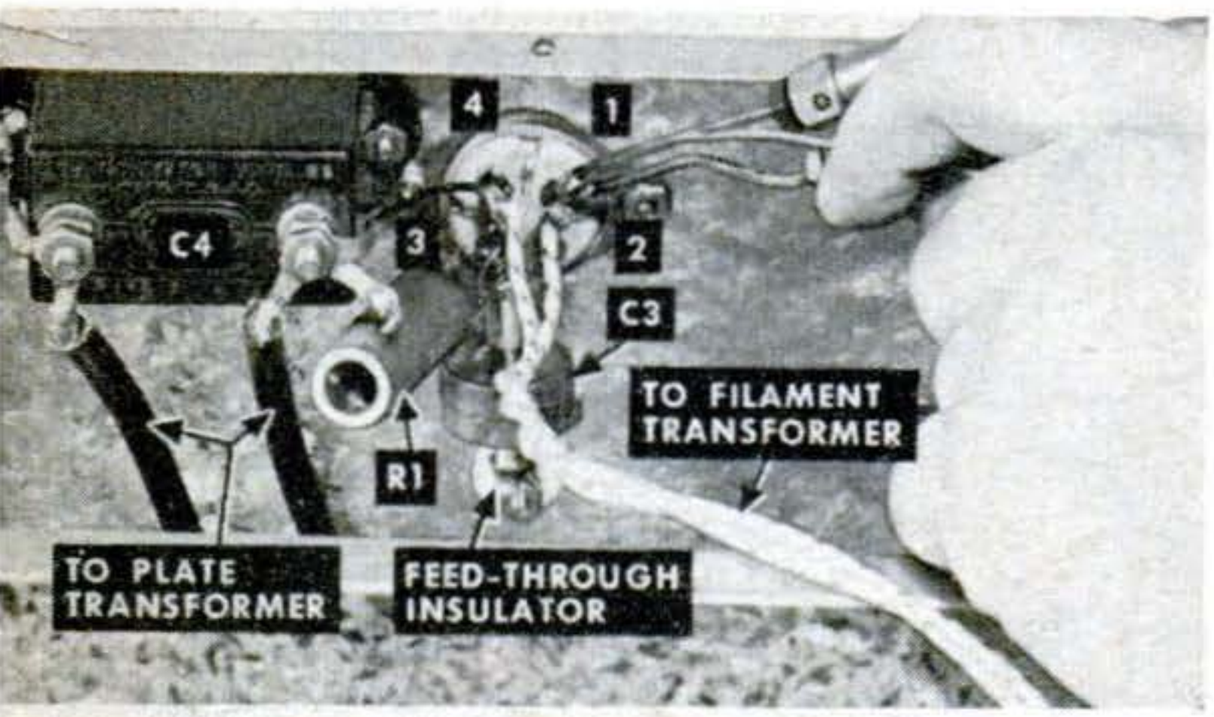
15. SEEN FROM BEHIND, the tube socket, at back of top deck, has pins 1 and 4 to the rear. Tesla coil is mounted with primary terminals and ground tap toward the rear. Capacitors C1 and C2 are close together, with the feed-through insulator between them and the coil. Plate transformer is inside, filament transformer (in hand) behind it. *(Please turn the page.)*



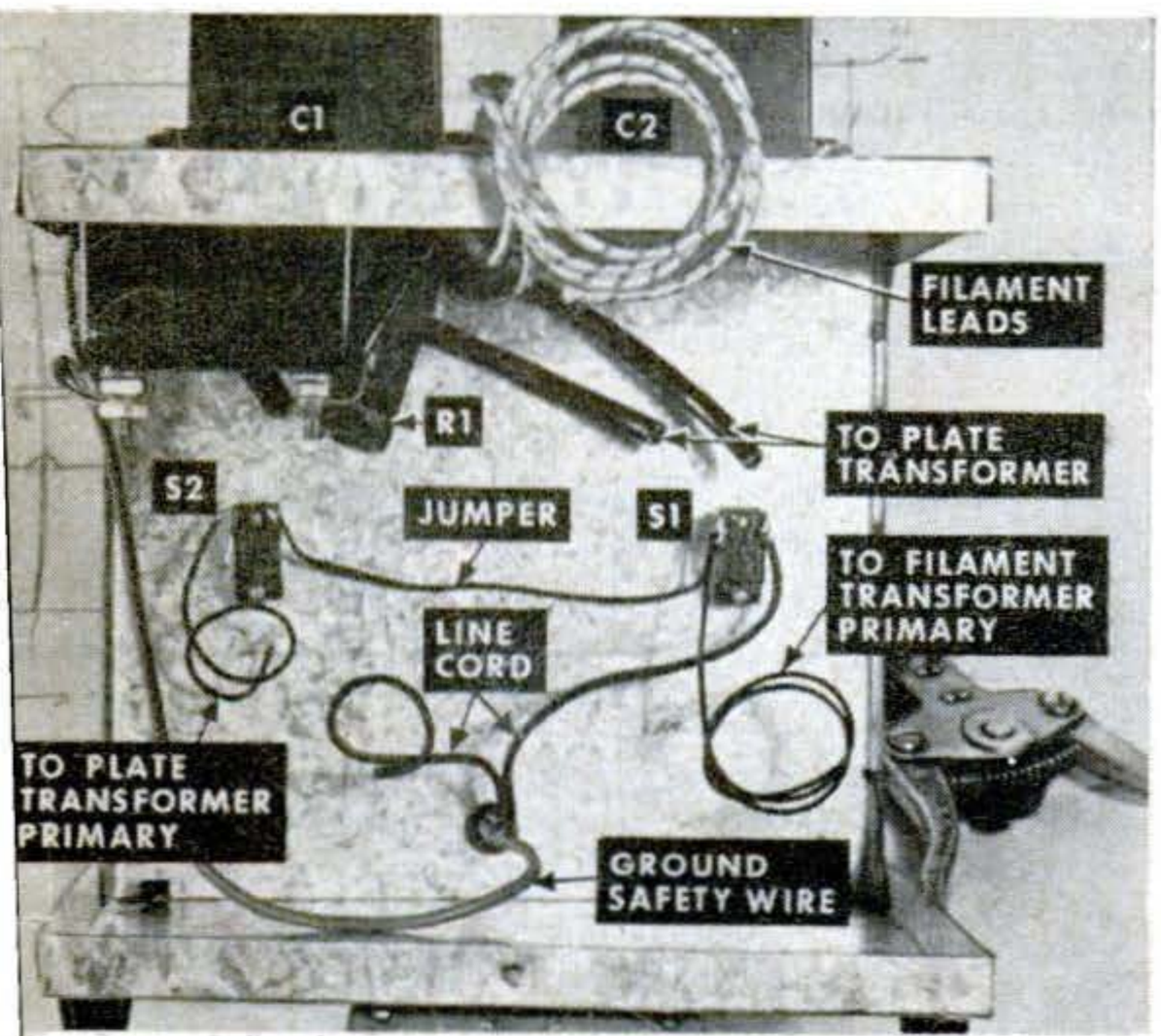




MARK MOUNTING HOLES with a long-pointed pencil, back up the sheet metal with wood, punch the centers, and drill. Spot holes for filament capacitor C4 so that it can be mounted upside down under rear corner of top deck near tube pins 3 and 4 as in photo below. If you have no chassis punch, make hole for tube socket by drilling a circle of small ones and filing between.



THIS UNDER VIEW of the top deck shows the ground connection for C4 soldered to a lug under one mounting screw. Grid-leak resistor R1 is connected to the other terminal of C4, along with a wire to tube pin 4. The grid capacitor, C3, goes between the other side of R1 (also hooked to pin 3) and the feed-through insulator. Leads from C4 to plate transformer must be high-tension ignition cable. Use No. 12 stranded wire with high-grade insulation from pins 1 and 4 to filament transformer. Pin 2 is not used.



The RF transformer. This is the heart of the Tesla coil and somewhat critical. Make no changes or substitutions if you can possibly avoid them. Since the primary coil is built up over the secondary, all operations should be in the sequence shown in the photos.

Firing up. First ground the power-cable clip, both as a safety measure and to minimize the possibility of radio interference, and plug in power cable. Insert the tube and connect its plate cap. Do not connect anything to the secondary coil terminal.

Turn on the filament switch. The tube should light. Holding a fluorescent lamp a few inches from the coil, turn on the plate switch. The lamp should glow. If it does not, turn the power off and check the wiring.

If the lamp glows, turn off the plate switch and stick a short piece of No. 12 wire into the hole in the terminal. When plate current is switched on, a crackling fistful of sparks should sprout from the end of the wire.

Metallic objects may be held directly in the hand and the sparks allowed to jump to the metal. Do not bring the hand itself close enough to the terminal to draw sparks; although there is no shock, they do cause small burns. Partially insulated objects should be held by a long plastic rod so that the potential will not jump through the insulation to your hand.

Trouble shooting. If the wiring is right and the tube is good but only a small spark appears, the secondary coil is probably off specifications. This means the circuits will be out of tune, and not oscillating properly. Rather than trying to doctor the coil, you can tune the circuits by juggling the value of capacitor C1, which with C2 controls oscillator frequency.

Try a value of 50 mmfd. larger or smaller than the 700 mmfd. specified for C1, and check coil action again. Odd values for C1 may be built up by paralleling several

[Continued on page 234]

POWER WIRING and switches as seen from rear of front panel look like this. The ground safety wire goes to the grounded terminal of C4. One side of the line cord from the AC plug is connected to the filament switch, S1. The other side of the line cord goes to one side of both transformer primaries. Cross connection of the two switches by the jumper as shown in the diagram makes it impossible to turn on the plate transformer until tube filament is on.

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Whirling Rotors Lift This Gyro-Kite

LOOK, MA, NO WINGS! Revolving blades alone hoist this frisky model on the breeze. Inspired by Igor Bensen's man-carrying gyro-kite (right), it has two contra-rotating rotors for stability.

Here is the liveliest aircraft-on-a-string you have ever flown. It's a cinch to put it together from balsa, wire and cardboard.

By Roy L. Clough

MUCH more fun to fly than an ordinary kite, this gyro-glider gets up in a moderate breeze and rides steadily aloft, rotors plopping about like a helicopter's.

Instead of a single tilting rotor like Igor Bensen's man-carrying machine (PSM, July '54, p. 98), which requires a pilot on board, this model has two semirigid coaxial rotors. These turn in opposite directions, keeping gyroscopic and lift forces in balance. A mast-mounted fin prevents sudden wind shifts from tipping the model over, while a boom-mounted tail takes over the pilot's function of keeping the rotors at the correct angle to the wind.

Build cabin first. Cement ¼"-square balsa sticks together as shown in the drawing on page 199 to make the cabin, doubling them for the front strut and rear cross member. Reinforce the corners with gussets of ⅛" sheet balsa. The apex through which the rotor shaft passes may be built up of

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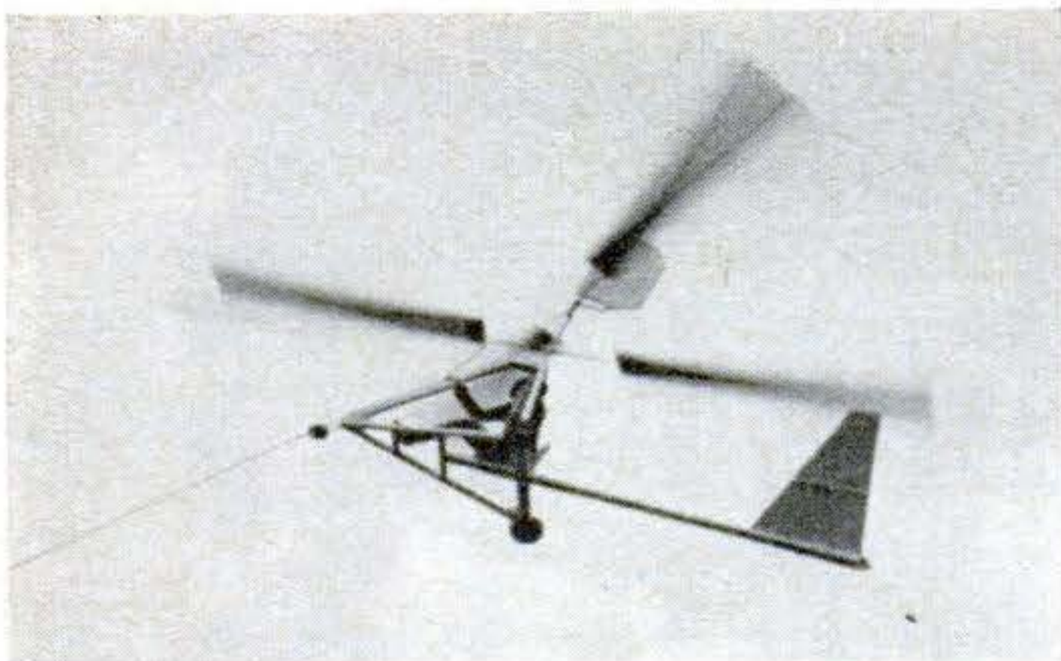
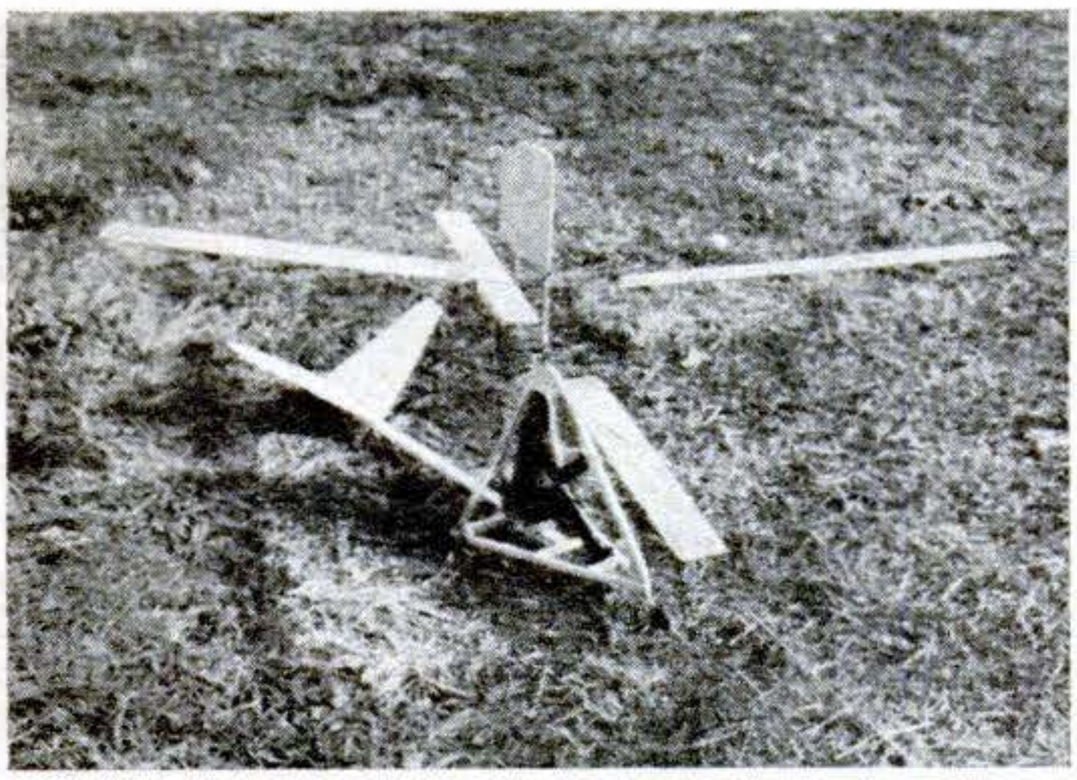


IT SPINS AS IT FLIES. There's action aplenty with both rotors whirling rapidly when the kite is up. Gusts will drop it a few feet or cause some rolling, but the craft regains flying trim so long as it has enough altitude.



TOO SKINNY TO FLY? There doesn't seem to be enough wing area for the breeze to lift it, but when the rotors start spinning the model is eager to climb. Landings are best made by hand: kite is unstable close to ground.

three gussets and a cap, or carved from a bit of hard balsa.

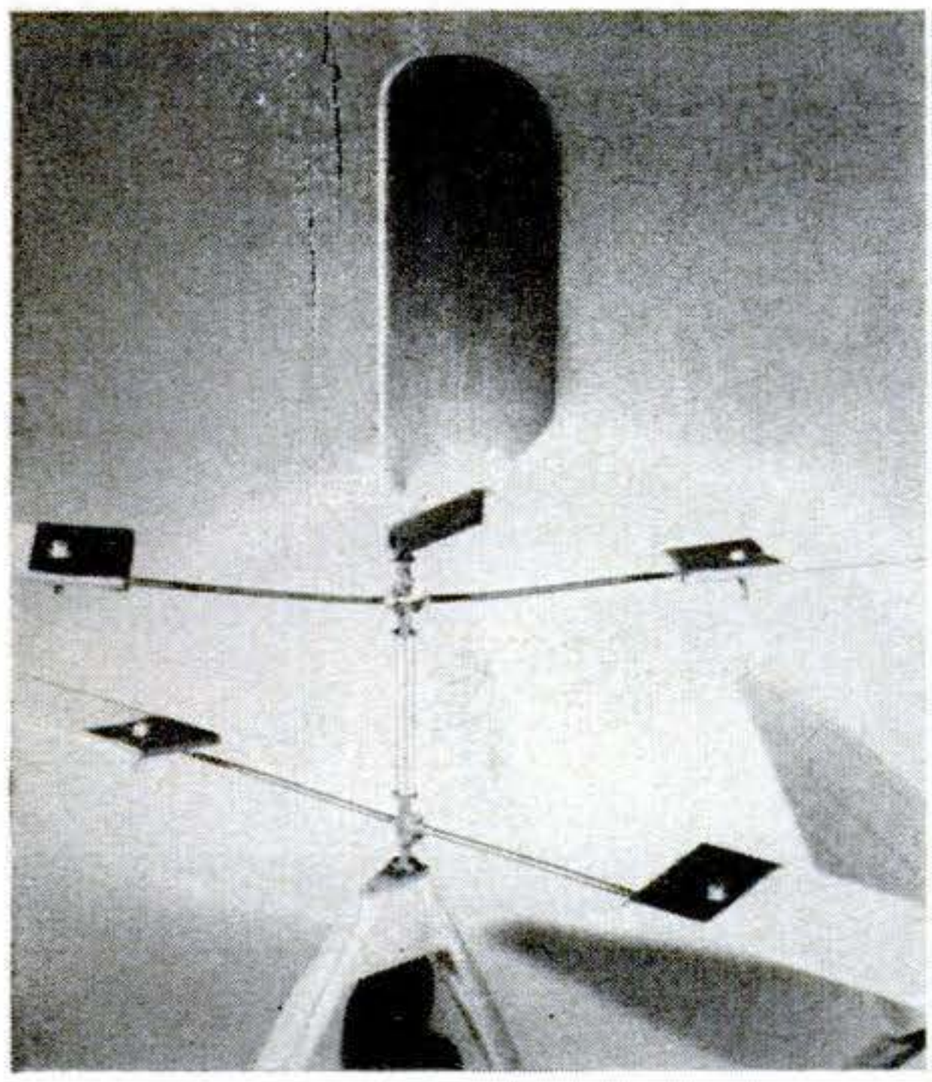
The tail boom, also two ¼"-square members, is cemented on top of the rear crosspiece but behind the middle one. This gives it an upward slope. Cut the tail out of 1/16" sheet as shown, score it down the center, break and recement to give a dihedral of 3" under each tip. Cement it to the boom with a wedge between, as shown.

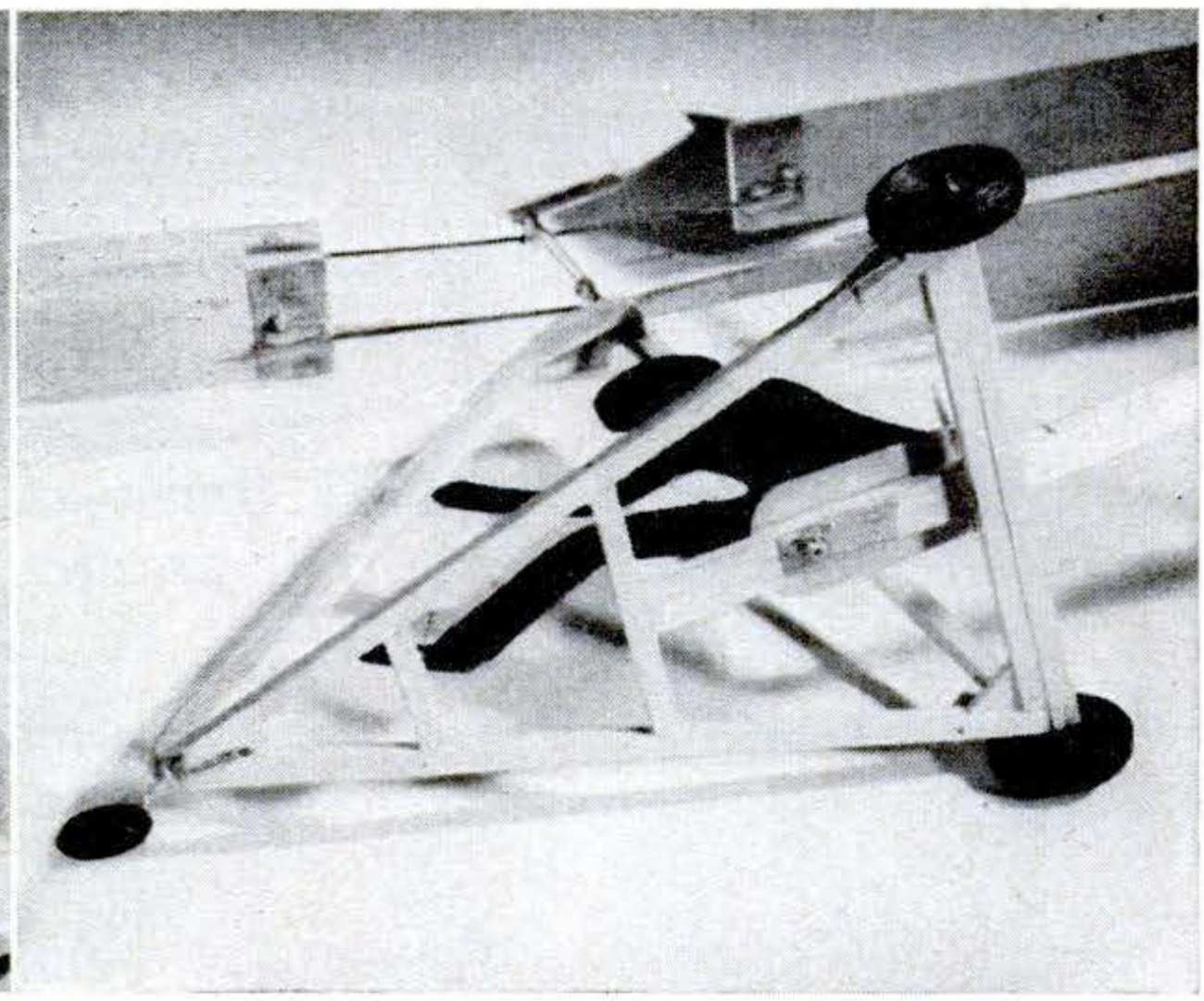
Wheels may be from a model airplane or a toy, and of course need not turn. Cut out the pilot and his seat from stiff cardboard. Cement the figure slightly off center to let the rotor shaft pass.

Making the rotors. Secure the rotor shaft from turning either by bending the lower end over and lashing it to the boom, or by soldering it to a bit of tin plate clipped around the boom as shown in the photo.

Make the rotor mounts from ¾" lengths of brass tubing, tin-plate clips, and 3/32" steel wire as in the drawing. Compensate for the off-center mounting by bending the wire slightly. Use acid-core solder for a good bond with the steel, but wash the joints afterward with baking-soda solution. Solder tin-plate clips to the rotor mounts at a right-hand pitch on one rotor and a left-hand on the other.

Use small washers and a piece of plastic tubing between the hubs to insure free turning. Solder a washer above the lower





ROTOR SHAFT is stationary, with metal clip for fin soldered to top. Rotors must spin freely. Upper wire mount of rotor is bent to form a dihedral, with about 4½" between rotor tips. Bottom view of cabin (right, above) shows lower shaft end fixed against rotation. Tin-can clip with a hole in it is crimped around tail boom. Shaft, pushed through hole, is soldered to clip. Rear wheels are pinned to back frame member; front one is mounted in wire yoke lashed to frame and cemented. Wheels do not turn.

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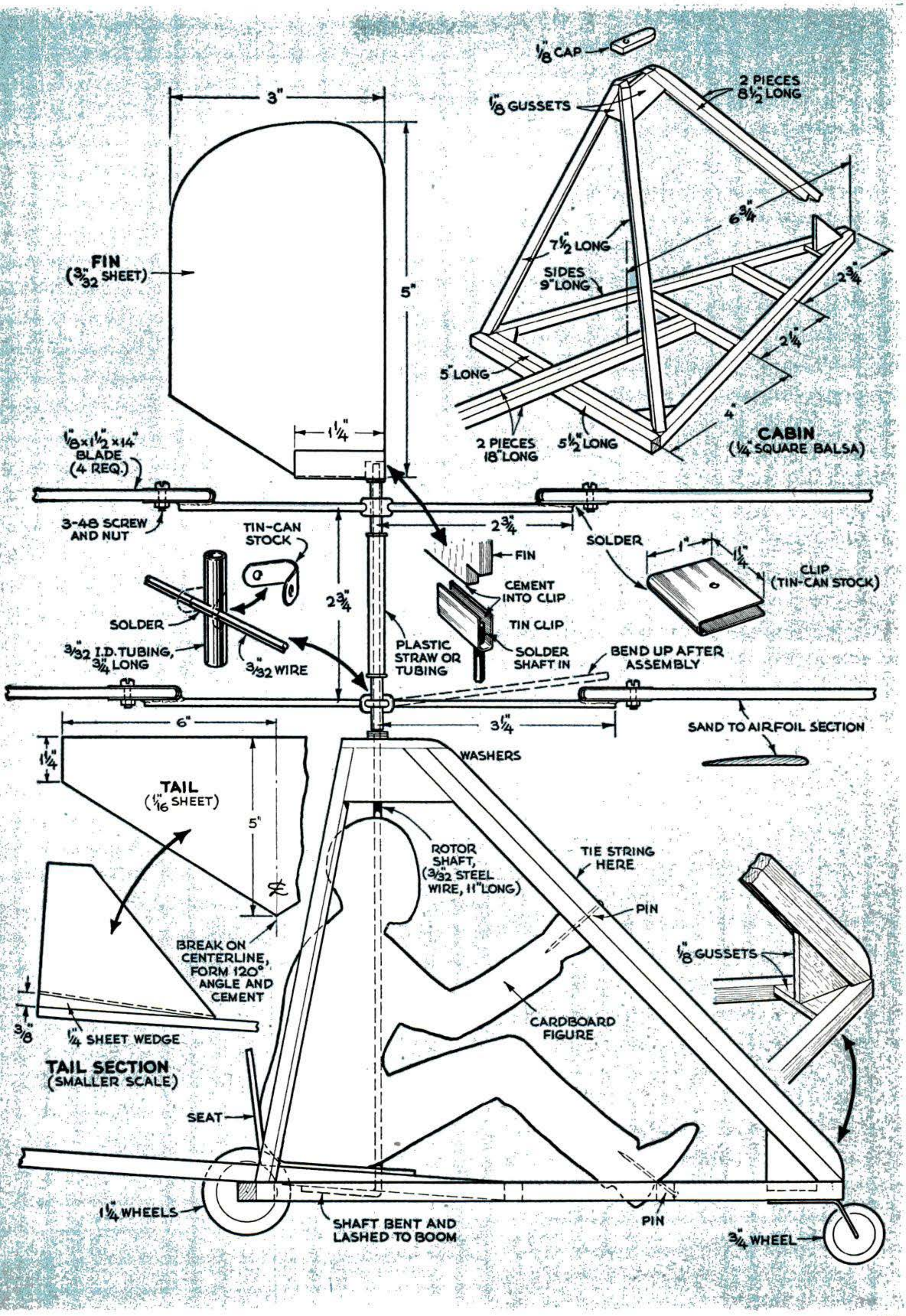

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rotor hub to the shaft so that the weight of the top rotor rests on the washer, not on the lower hub. Make four blades of ⅛″ balsa, sanding them to a uniform airfoil section. Bolt them into the clips, and bend up the upper blade mounts to separate the tips of the two rotors by 4½″ or 5″. This prevents blade clash and minimizes interference due to rotor wash.

Do not try to simplify the rotors by using a solid wooden hub. The spring wire mounts take the place of drag dampers in the real thing; without them, the blades would shatter in anything more than a mild breeze.

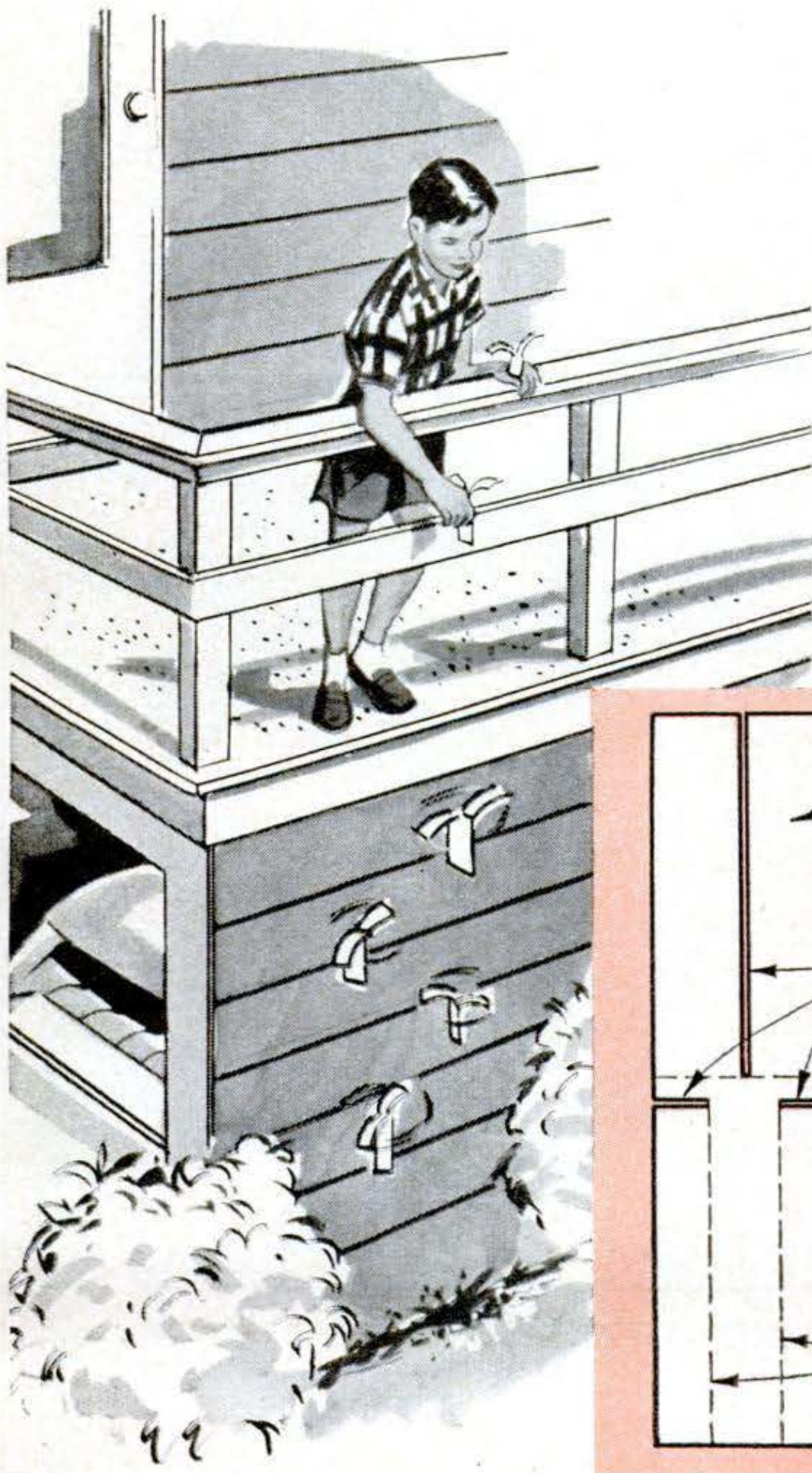
The fin clip at the top of the shaft retains the rotors. Be sure it is aligned with the tail boom; then cement the fin into place and squeeze the clip around it.

How to fly it. Tie strong kite string to the front cabin strut just above the pilot's arm. In a moderate breeze, hold the model at about 45° to the wind and let the rotors come up to speed. When both are spinning as fast as they will go, release the model and quickly pay out a few feet of line to let it reach its own equilibrium. If everything is right it should continue to rise, with the rotors spinning freely, until it reaches its ceiling. This is determined by the weight of the string, the wind velocity and where you tie the bridle.

Should the model tend to roll over, first check the alignment of the tail and fin. If this is correct, one rotor is probably turning faster than the other.

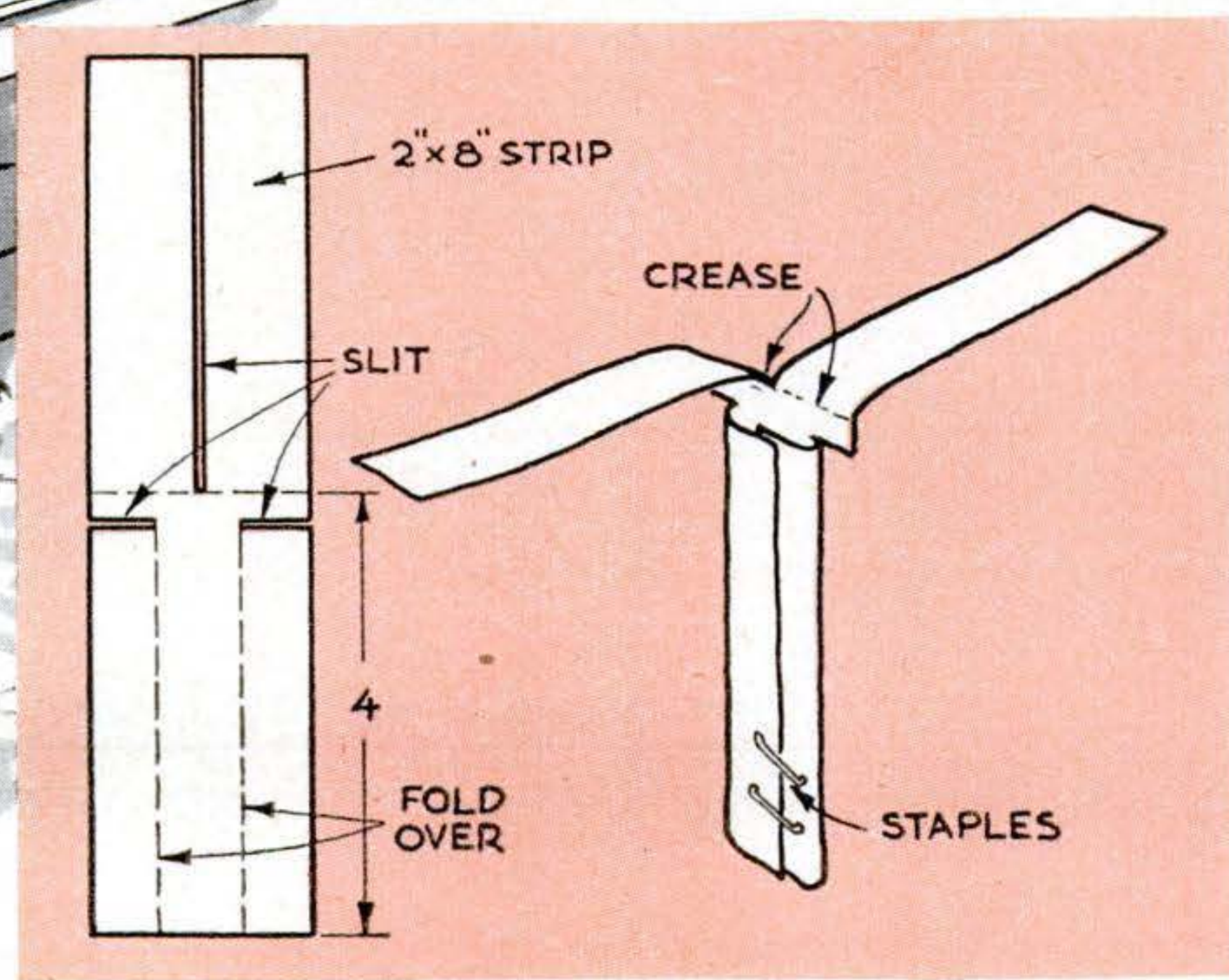
Twist a bit more pitch into the slow rotor by bending the blade clips gently. For top lifting efficiency, however, keep the pitch of both rotors as small as is consistent with fairly high turning speed. END

Twirlichutes Are Fun to Sail, Take Only 30 Seconds to Make



WHAT'S a twirlichute? It's a spinning parachute, made of paper, that twirls merrily as it glides to a soft landing or soars aloft on a breeze. Maple seeds do the same thing every spring, but with these paper toys you, plus all the kids who'll gather around you, can have fun at any season.

Use ordinary pad or typewriter paper, not card or stiff stock. Slit and fold a strip three or four times as long as it is wide. Crease the wing roots lightly, letting the wings droop in opposite directions. They work best if floppy, not stiff. Weight the bottom with a small paper clip or two staples.—*O. P. Ortberry, NYC.*



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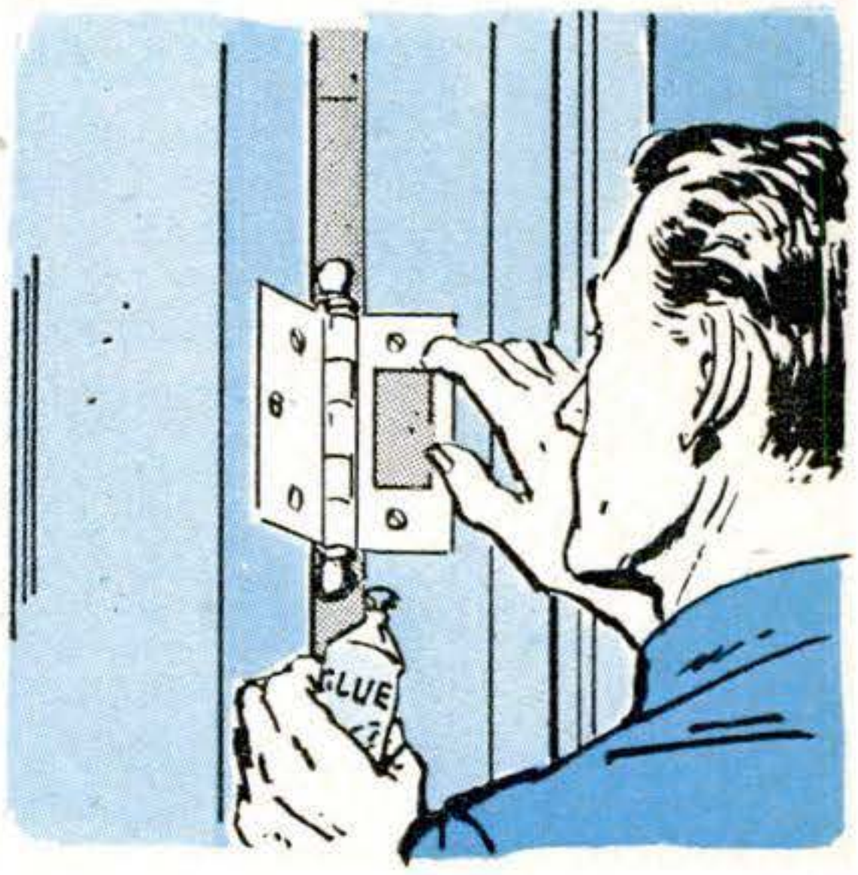
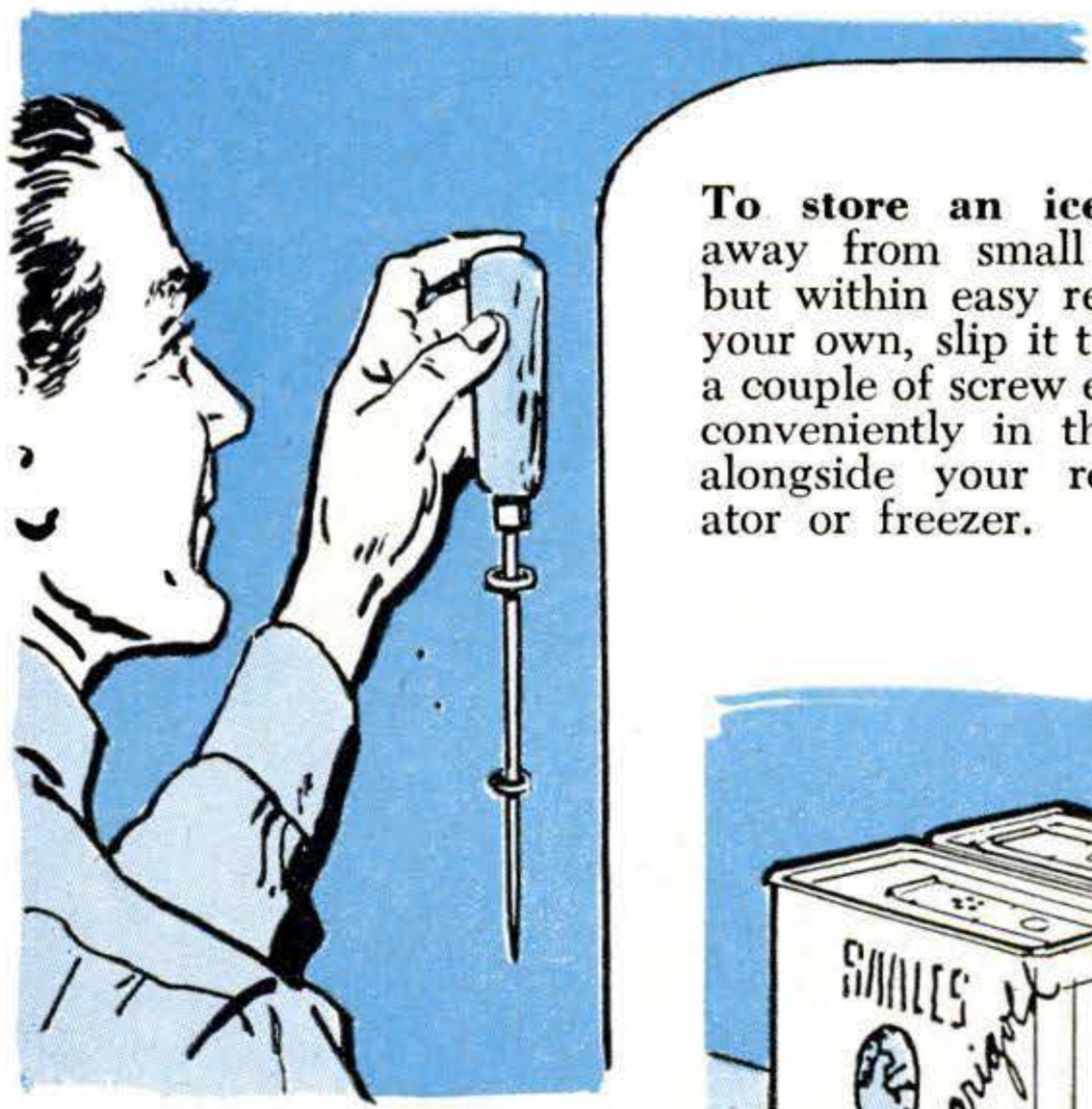
KEEPING THE Home SHIPSHAPE

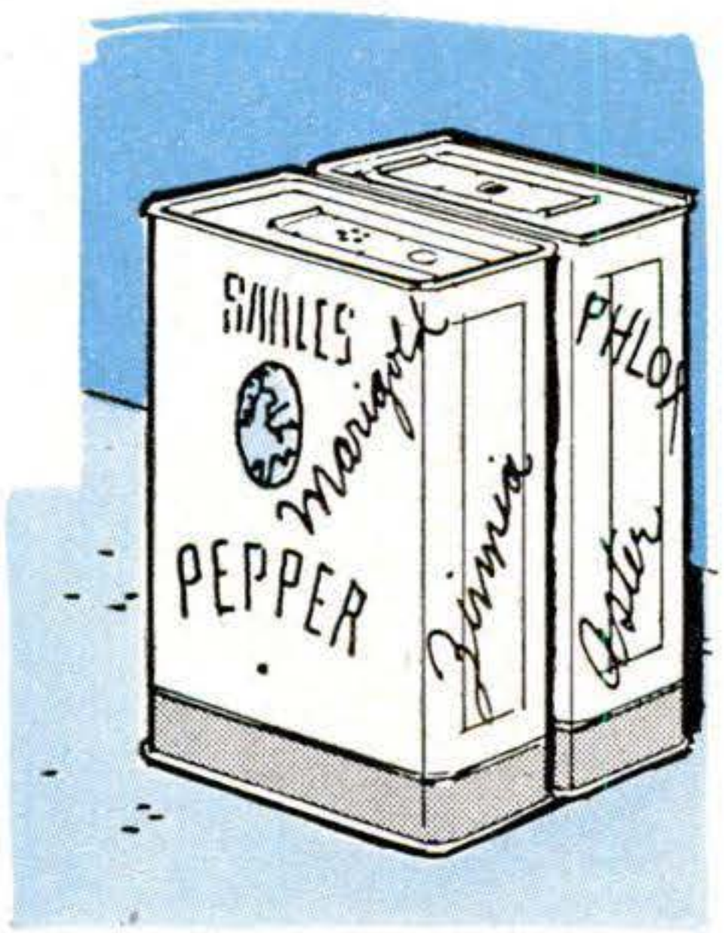
A knockdown table of plywood is handy for roadside picnics or camp meals. Cut the top to fit the car trunk and screw floor flanges to the underside to take legs of iron pipe. Store it near your kitchen and it will do temporary duty when more counter space is needed.



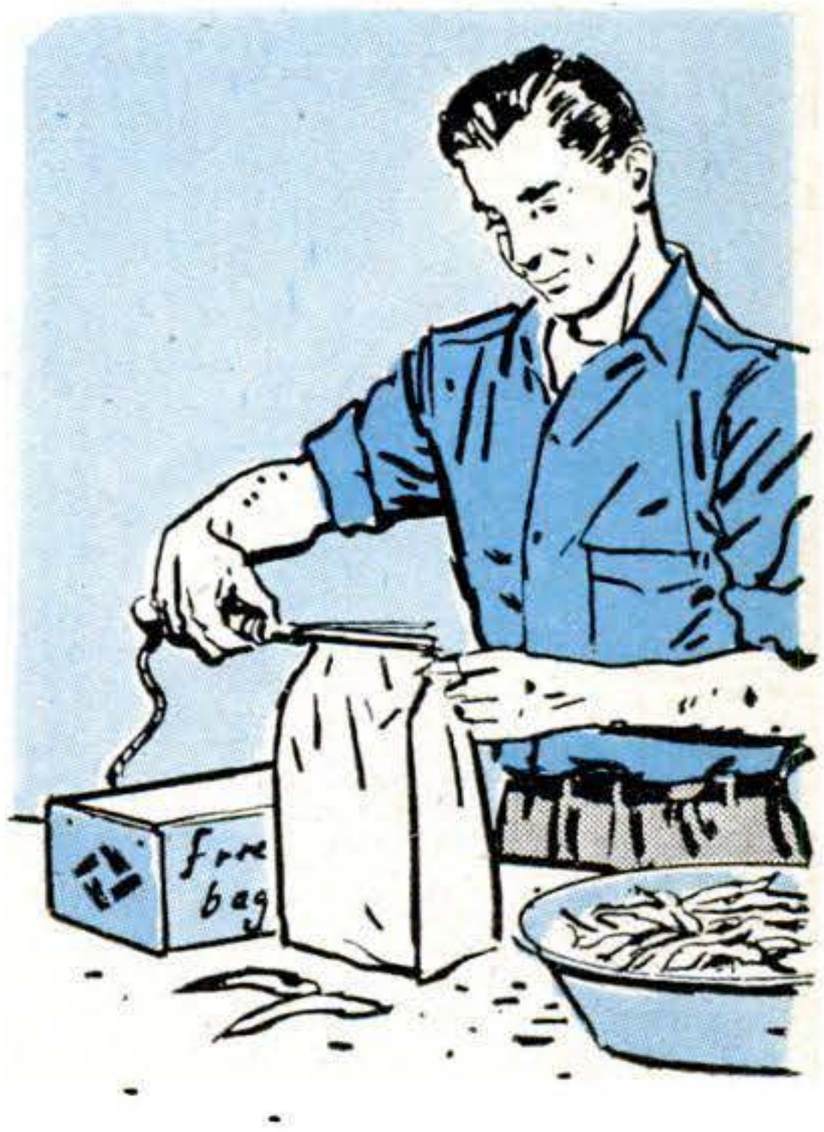
If the catch rattles when an interior door is closed, a small pad of sponge rubber cemented to one leaf of each hinge will quiet it. A sponge-rubber powder puff will supply more than enough of the material needed for the job.



To store an ice pick away from small hands but within easy reach of your own, slip it through a couple of screw eyes set conveniently in the wall alongside your refrigerator or freezer.



For easier sowing next spring, gather this year's flower seeds in empty spice cans. The fine seeds can be sifted to the soil through the small holes; the big fellows will pour from the large slot under the sliding top.



Freezing your harvest? An old-fashioned electric curling iron can speed the work. Faster than a pressing iron, it seals the plastic bags while they stand upright. Use only moderate heat.

Please turn the page for more home tips.

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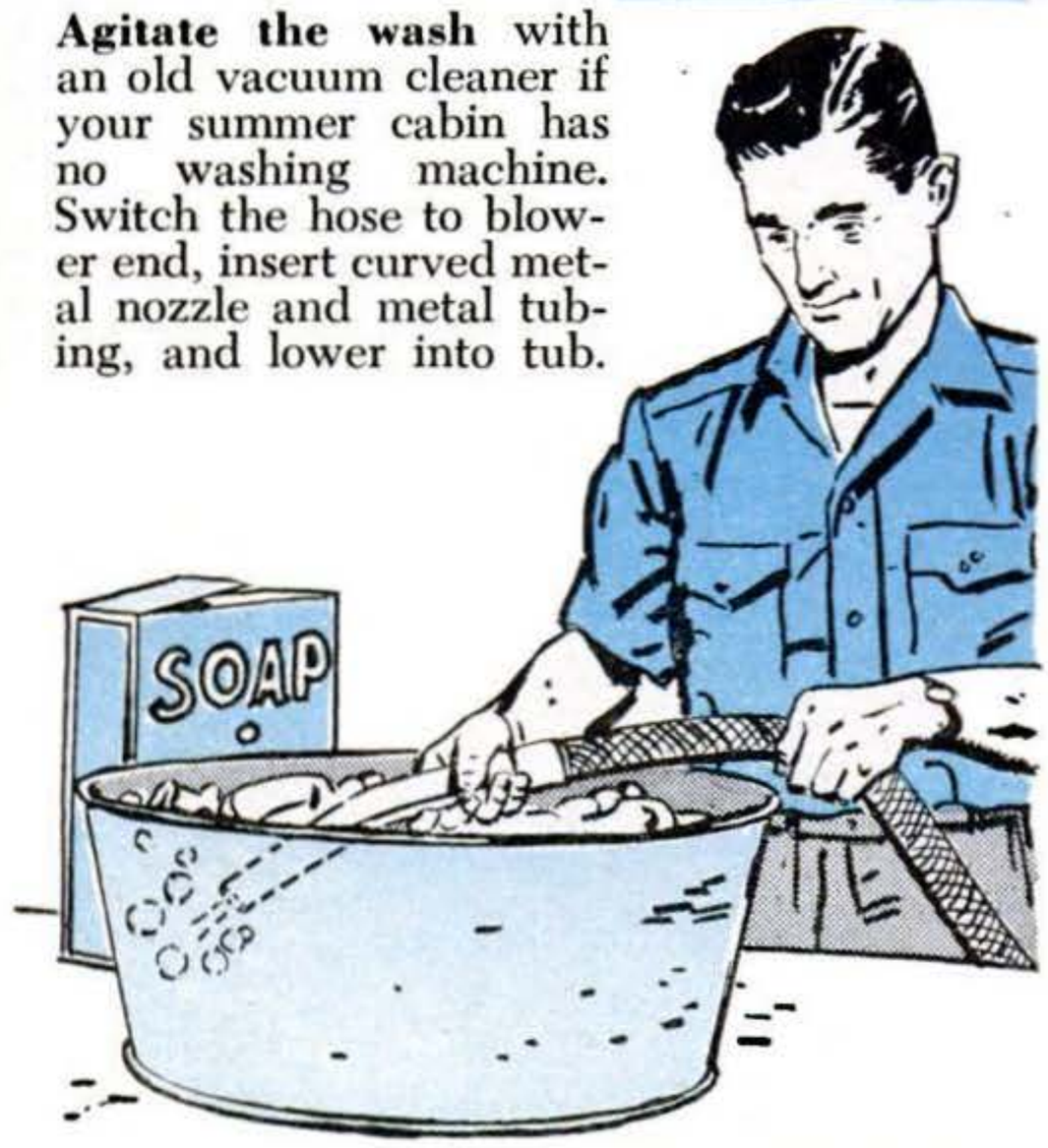
More Home Tips

Pop go the wieners, three or four at a time, if you roast them by shaking them over the fire in a corn popper. Caged in wire, not a frank is ever lost in the flames.

A too-short pump will reach the last of the insecticide in a spray bottle if you lengthen it by adding a piece of drinking straw or by wrapping it with tape.



Agitate the wash with an old vacuum cleaner if your summer cabin has no washing machine. Switch the hose to blower end, insert curved metal nozzle and metal tubing, and lower into tub.

A portable clothes dryer for motel-hopping travelers can be made by binding together two wire hangers and a cake-cooling rack. Lash the parts with cord or wire, keeping it loose enough to allow the dryer to fold flat when it is not in use.

Hang your bug gun in an empty juice can slit down the side seam and opened part way at ends. Flap bent back and cut in at sides forms handle trough. Brace it with plywood and screw top of can to wall.

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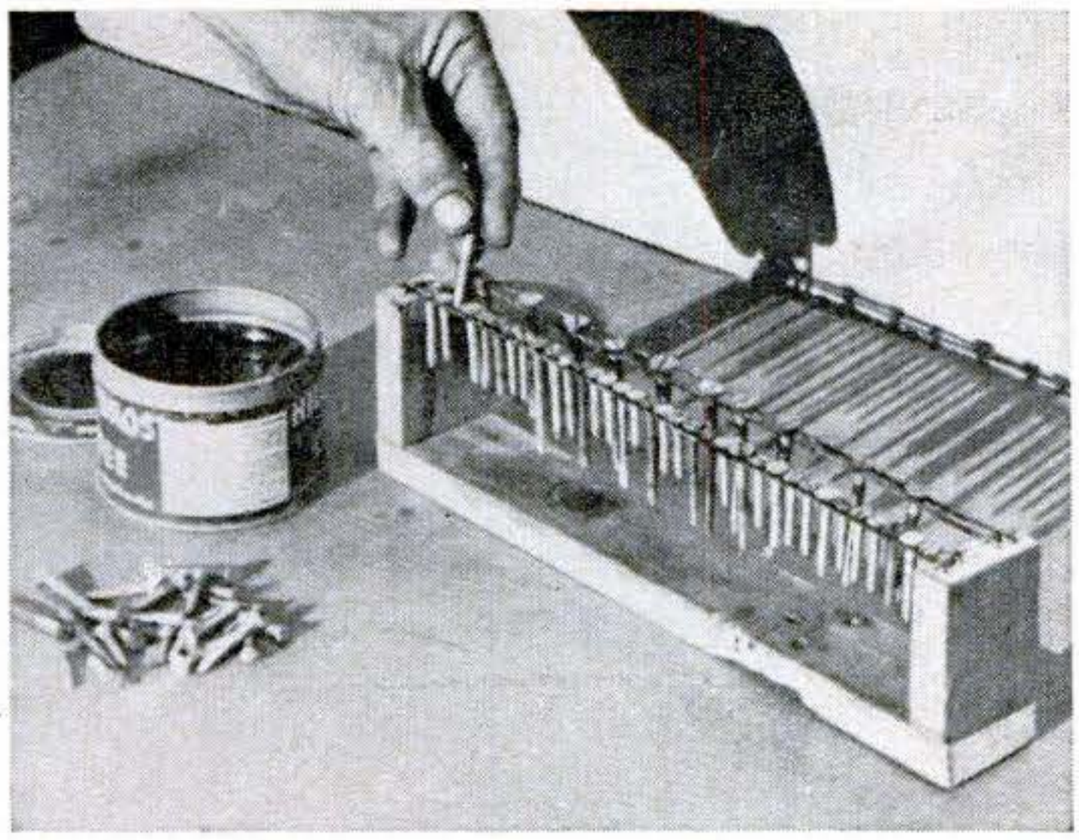


Screws Wax-Dipped in Quantity

To COAT screws for driving into hardwood, dissolve some paraffin, dip the thread into it, and hang them between wires on a wood frame like this to dry. Melted wax or soap paste can also be used.—*Clinton R. Hull, Costa Mesa, Calif.*

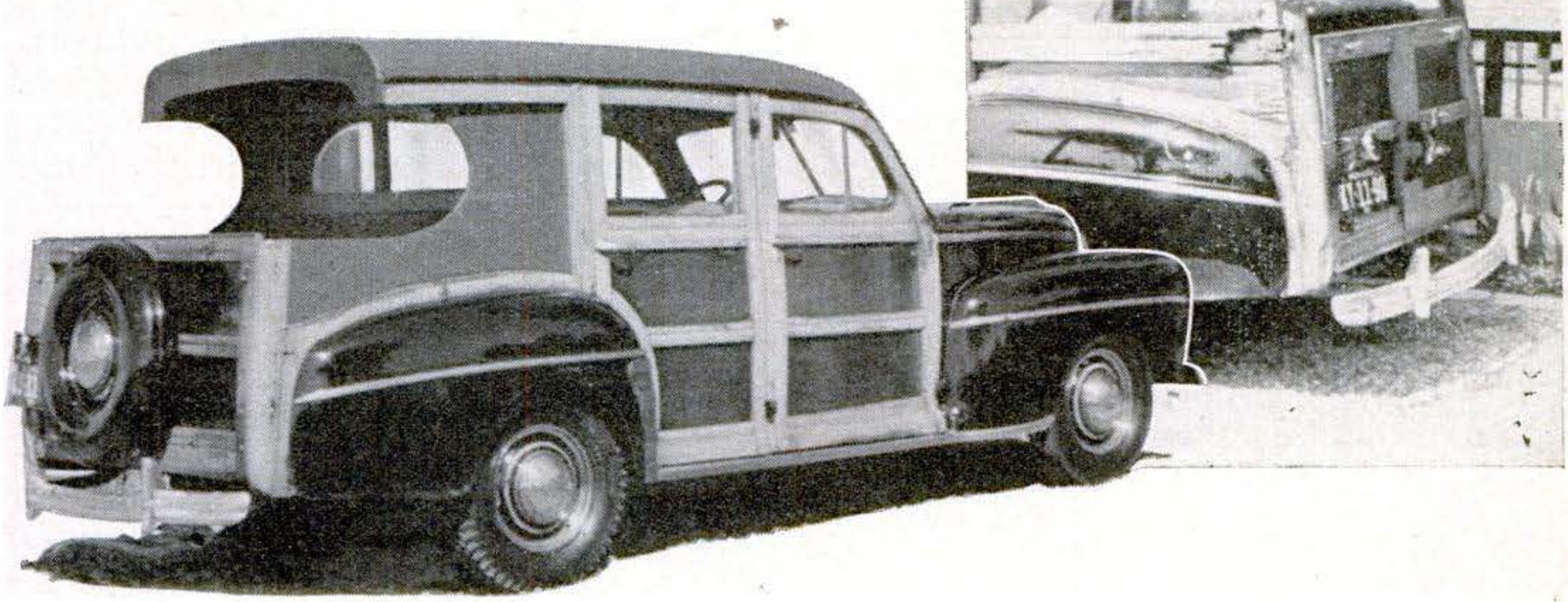
Keeping an Eye on the Pupils

A REAR-VIEW mirror mounted over the blackboard enables one teacher to keep an eye on the pupils with her back turned.

One-Boy Seesaw Hooks to House

A SHORT plank hinged to the side of the house and held by a strong spring will give a child a lot of fun on days when there's no one around to play with. Use a two-by-eight about 5′ long and pad the seat end with cloth or burlap. Make sure the screw eye is firmly attached to the house.—*V. H. Lamoy, Upper Jay, N. Y.*

Beat-Up Station Wagon Converted into a Handsome Pickup Truck



ECONOMICAL conversion instead of costly rebuilding has improved the utility of our wooden-body station wagon. For an outlay of $55.60 we now have a vehicle with pick-up-truck capacity and passenger-car riding qualities.

The photos show what we started with —and what we now have.

All decayed wood was stripped away from the rear of the body and the rotted part of the top sliced off. Side sweeps shaped from ⅜″ exterior plywood were then installed in the rear body panels. Stanchions at the rear corners were cut off at tailboard height. Other changes included a bulkhead behind the middle seat and a plate across the end of the cut-off top. Removal of the rear seat from the vehicle gives us easily accessible rear cargo space.—*Bill Knodt Jr., Essexville, Mich.*

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This Car Flashlight Is Always Bright

With a steady boost from your auto battery, the dry cells in your flashlight will give you a good light and last a long time.

A GOOD flashlight can be a lifesaver on the road—but one that has been cooking in a hot glove compartment for months may let you down.

This home-rigged flashlight has two slick tricks up its sleeve. In the car, it travels on a mount hooked to the electrical system. This keeps the dry cells up to strength much longer than usual. A powerful magnet bolted to the flashlight case both holds it in the mount and lets you stick it to any steel part of the car, leaving hands free.

The reviving gimmick. It's a fact that dry cells can generally be kept at full strength longer by feeding them a little direct current between periods of use. This is *not* like the recharging of a storage battery, and it will not restore dead cells. But it will stretch cell life considerably.

Begin with a plastic or rubber-cased flashlight using two standard D cells. (You need an insulated case because a metal one would short out the magnet and bolt that serve as the booster contacts.)

Building the mount. I keep my light on an open shelf under the dash. The magnet snaps onto a small steel channel, and a brass leaf insulated from it touches the bolt on the case. A No. 44 radio pilot bulb in the circuit limits boosting current to about 100 milliamperes, and also indicates the condition of the cells. Do not use any other bulb.

Connect the brass leaf to the positive and the magnet saddle to the negative side of the car's electrical system. If you don't know which is grounded in your car, see whether the battery posts are marked and which has the ground strap on it. If this doesn't show, assemble the rig and put the flashlight in place, its switch off. Then ground one wire and just flick the other on a live terminal.

If the pilot bulb flares brightly, reverse the booster leads. With good cells, it should just glow yellow-orange when correctly

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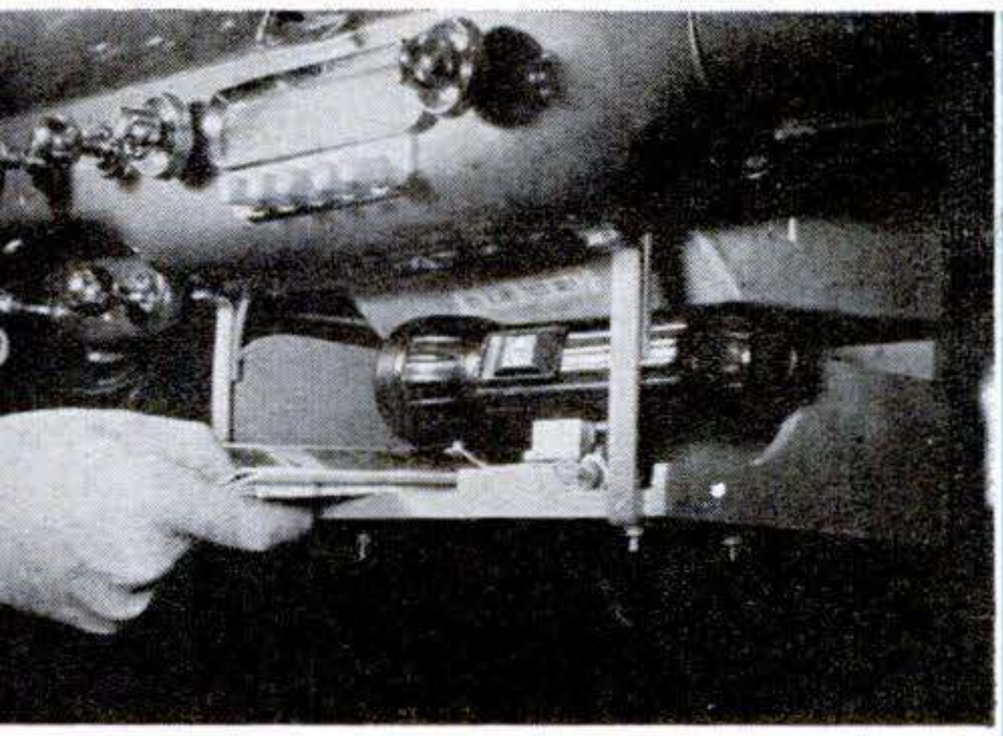
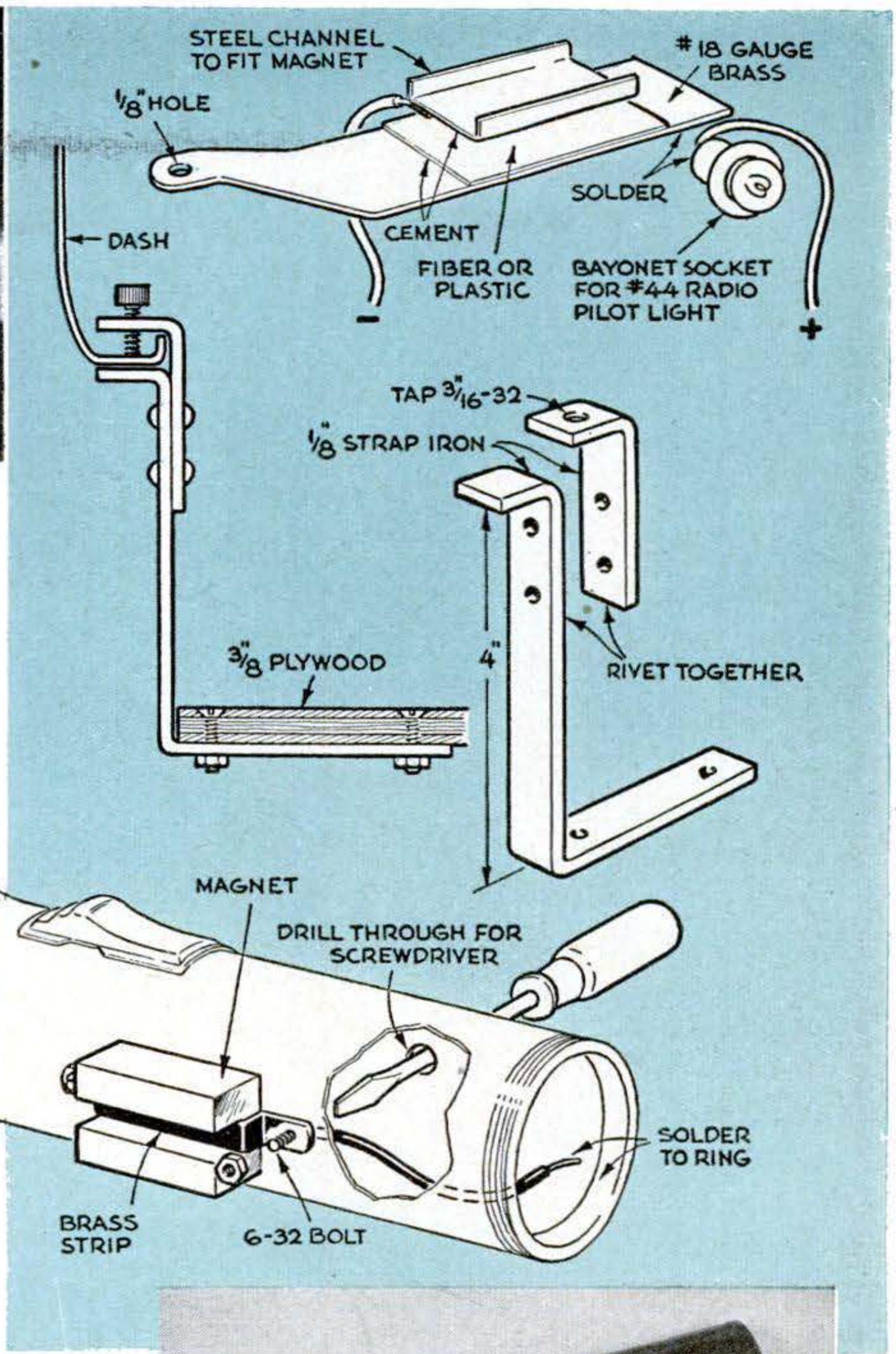
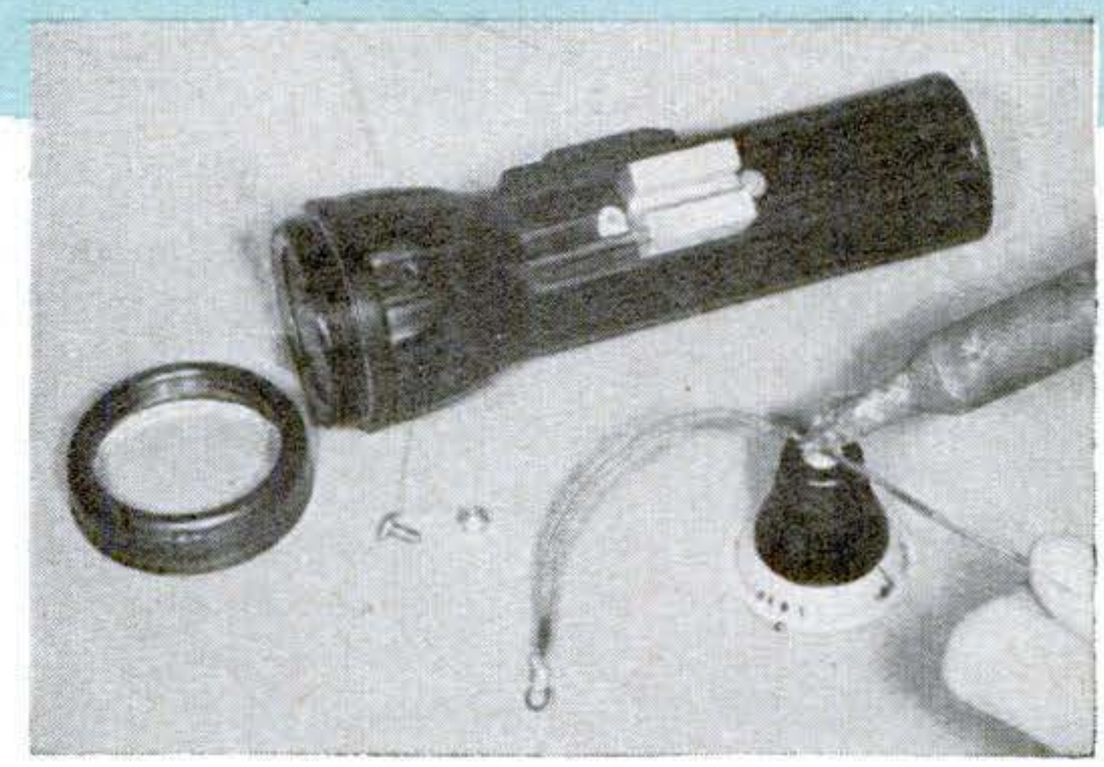


YOU'RE ON THE BEAM with flashlight cells that get a boost as you drive. One place for the booster mount is an under-dash shelf like this, which is handy for maps and sunglasses too, often eliminating that long reach to the glove compartment. Brackets are bent from strap iron as at right, and clamped to the dash flange with hollow-head screws.





BEND LIGHT STEEL to channel shape for the magnet saddle. Sandwich it, a piece of fiber, and a brass leaf together with metal-bonding cement as in the drawing. Wire channel to negative side of car's system, brass leaf to the positive. To convert flashlight, solder 3" insulated wire to the button on back of bulb holder (right). Connect it to a 6-32 bolt and acorn nut in the flashlight head. Magnet, available as a cupboard catch, is attached with brass clip. Solder a wire from rear clip bolt to the metal ring at end of the case.

hooked up. For permanent connection, take the hot lead from something constantly energized, like the cigarette lighter. Don't tap the switched side of the ignition, for with the key off, the dry cells will drain back through the dash gauges. An on-off switch is optional; you can simply put the light on its mount backwards to take it off the booster line.

Checking cell condition. Run-down cells have lower internal resistance than fresh ones, and will let the pilot burn yellow-white. As they come up to strength, the pilot should dim. But with worthless cells, it will glow brightly even after long boosting. To protect the flashlight bulb, don't turn it on when the case is in its mount. Avoid letting the magnet and contact bolt touch metal simultaneously, as this shorts the cells.—*Hugh Smiley Jr., Henniker, N. H.*

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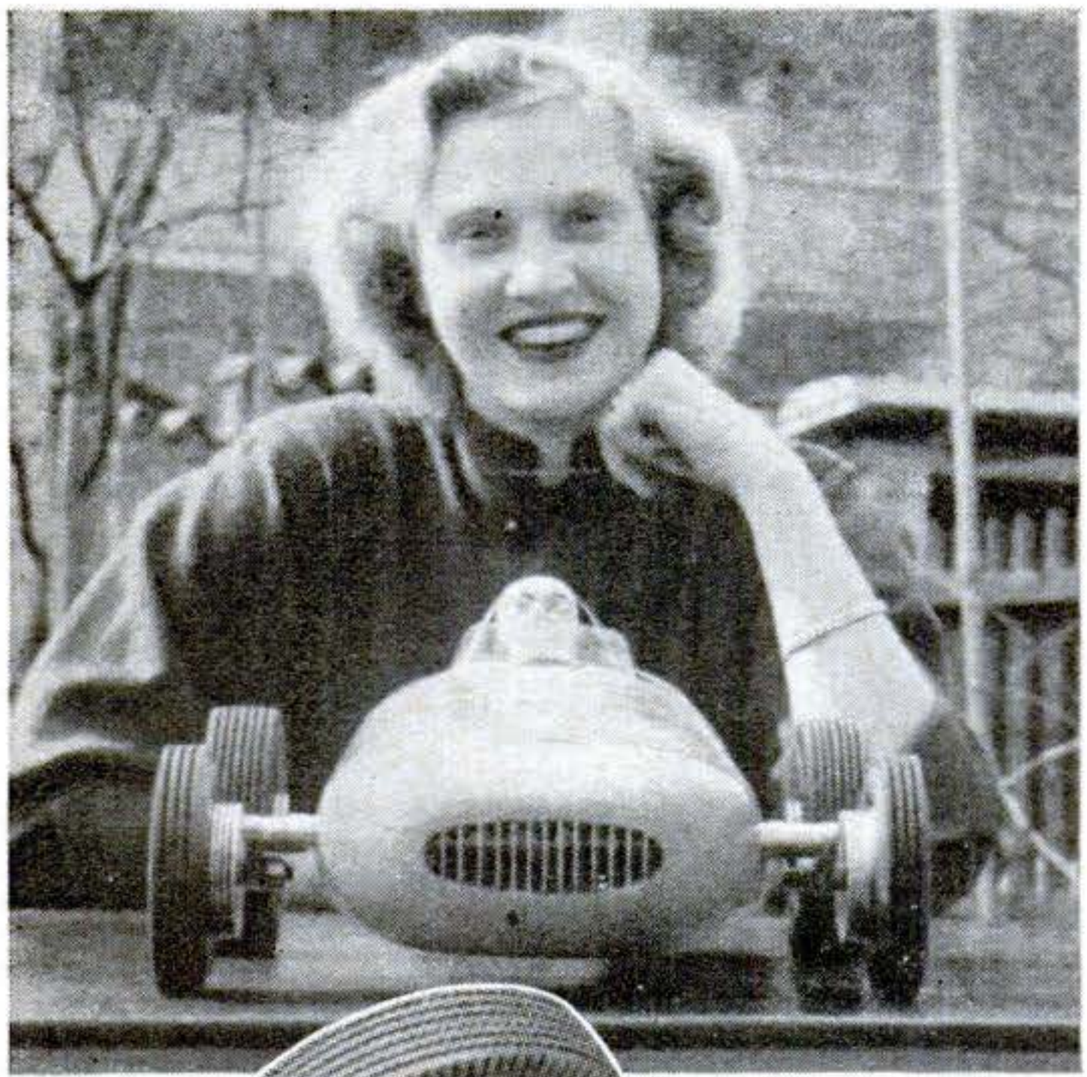
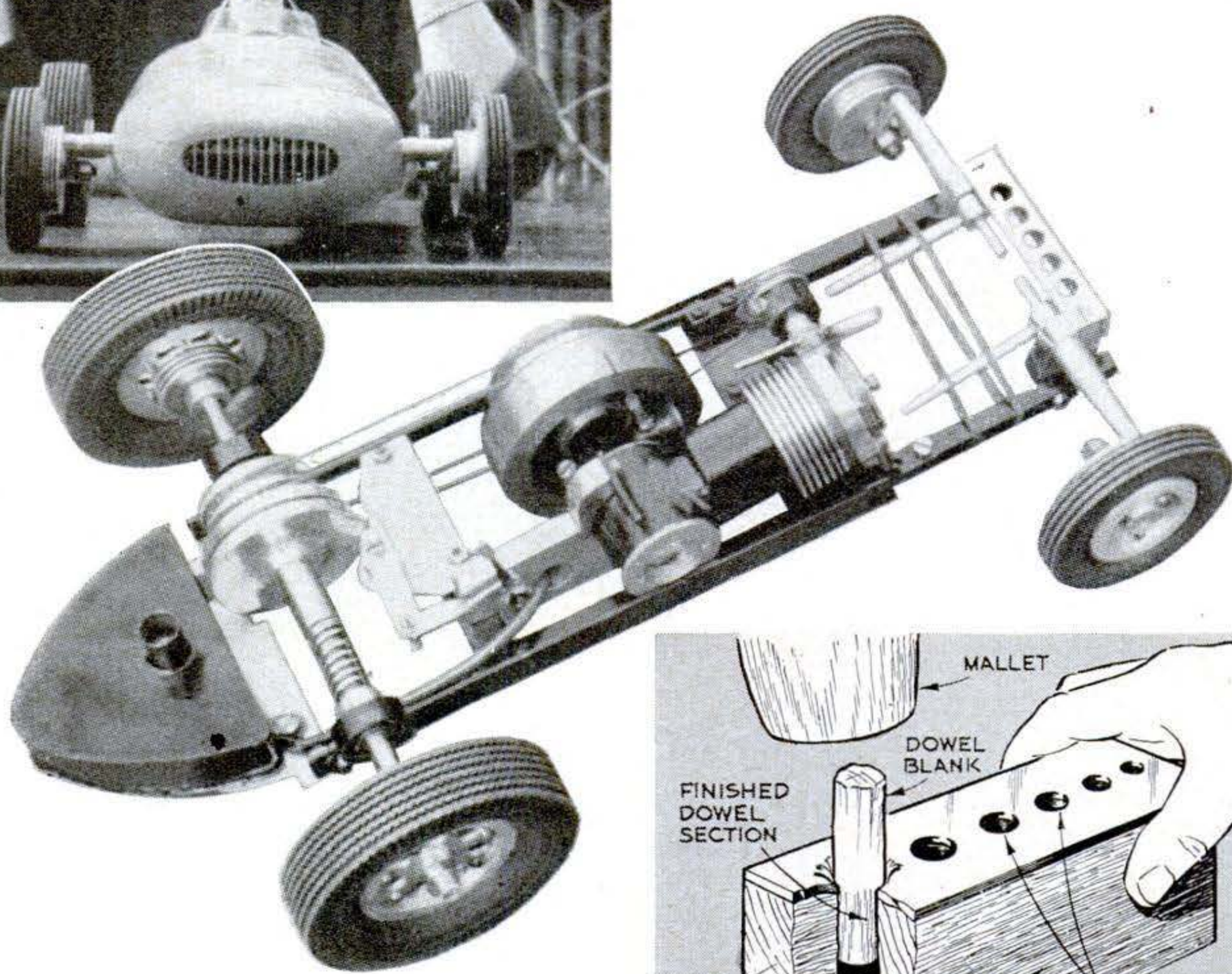
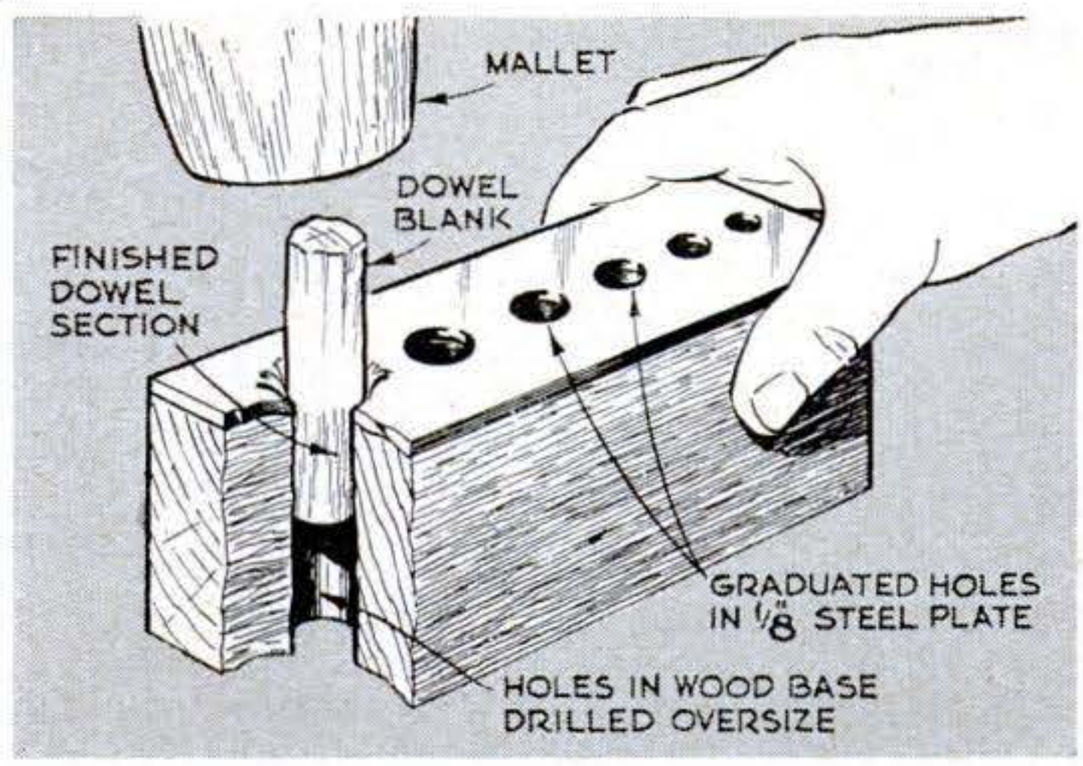
High-Speed Model Racing Car Is Fitted with Clutch and Fan



EVERYTHING but a dashboard tach is in this working-model racer, built by Otto Amrein of Basel, Switzerland. He made all parts except the tires and ball bearings in his home shop. It has a two-cycle engine of 10-cc. displacement, fan-cooled by a belt drive. A separate belt transmits power to the automatic clutch on the rear axle. Front wheels are independently suspended. Amrein is shooting for 100 miles an hour.



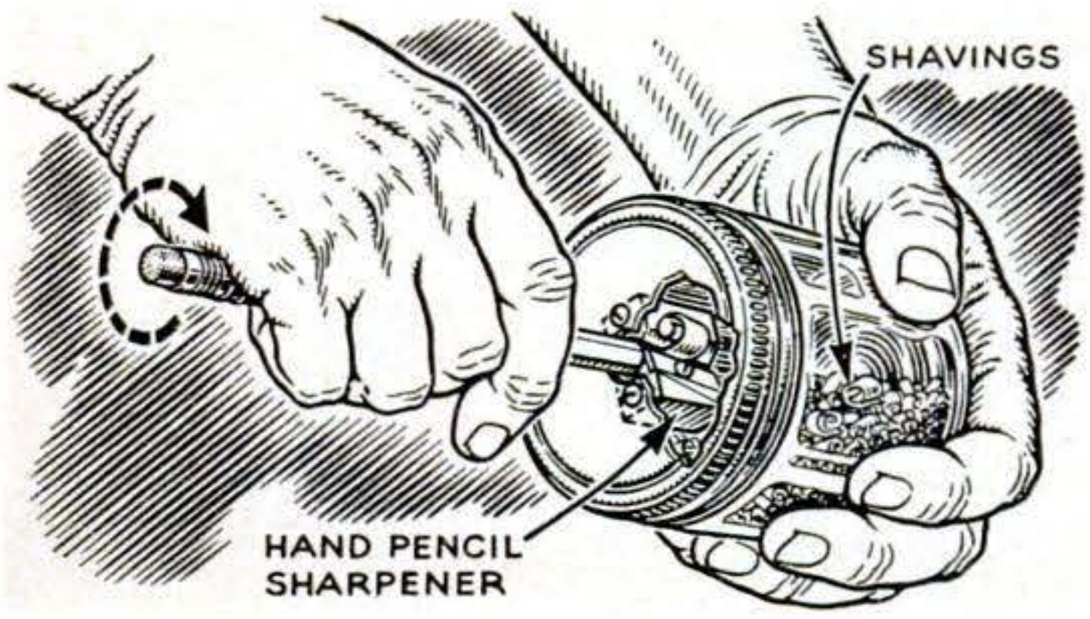


Dowel Jig Slims Them Down

OVERSIZE or out-of-round dowel stock can be salvaged with this jig. You can also make your own dowels, in various sizes, from wood of irregular section.

The jig consists of a steel plate, with holes of graduated size, screwed to a wood block. Oversize holes in the block provide clearance for the dowels being formed. Stock is forced through the jig with an arbor press or a mallet.

When the edges of the steel-plate holes become dulled, new cutting edges may be established by re-drilling each one with a drill one size larger than the original.—*J. E. Cushman, Stonington, Conn.*



Jar Catches Pencil Shavings

MOUNTED on the inside of a metal jar top, a hand pencil sharpener is easier to use, and the jar catches the shavings. Run two self-tapping screws through the lid into holes drilled in the end of the sharpener. Drill a 3/8" hole to admit the pencil.—*Rufus P. Turner, Los Angeles.*

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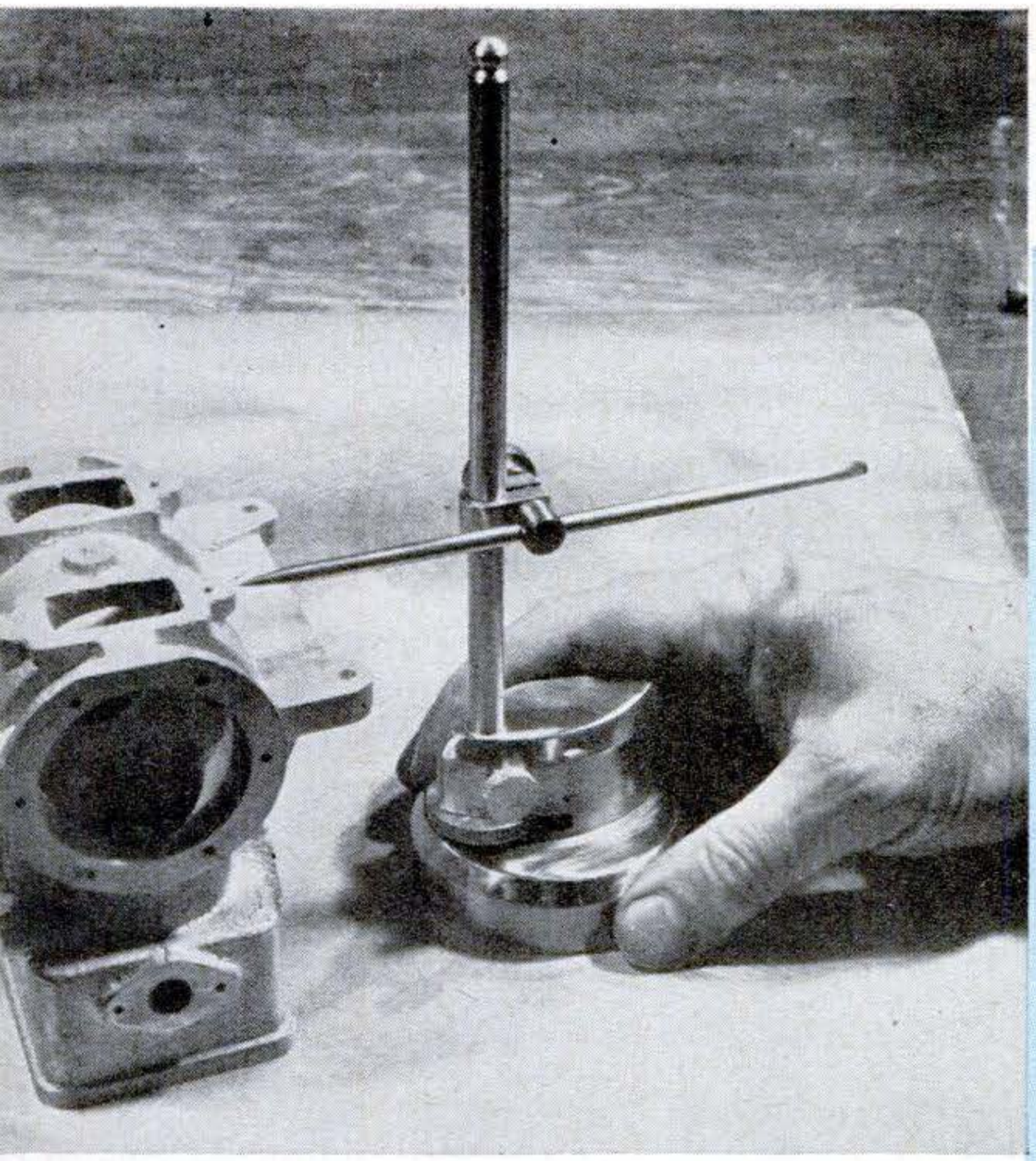
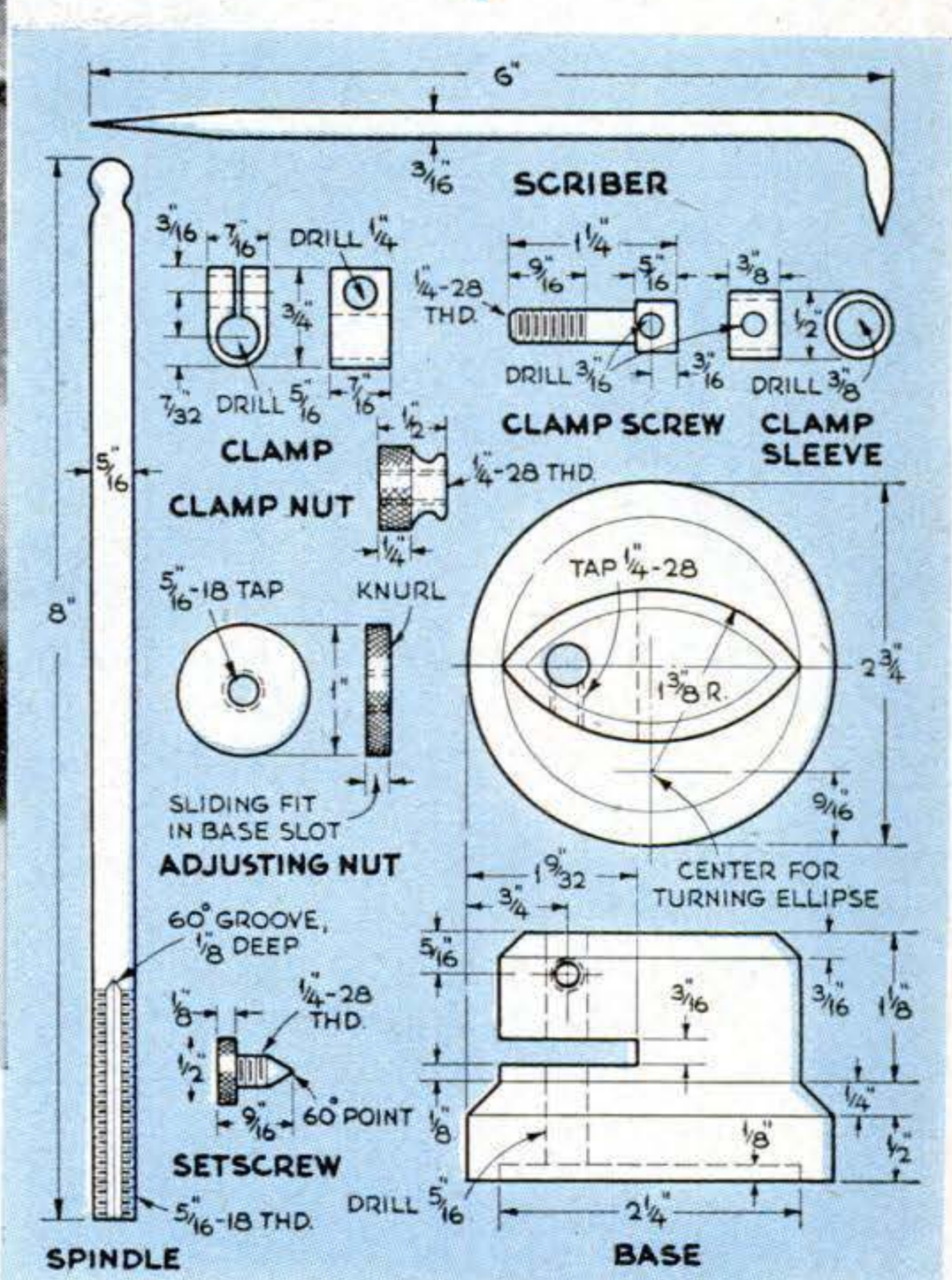
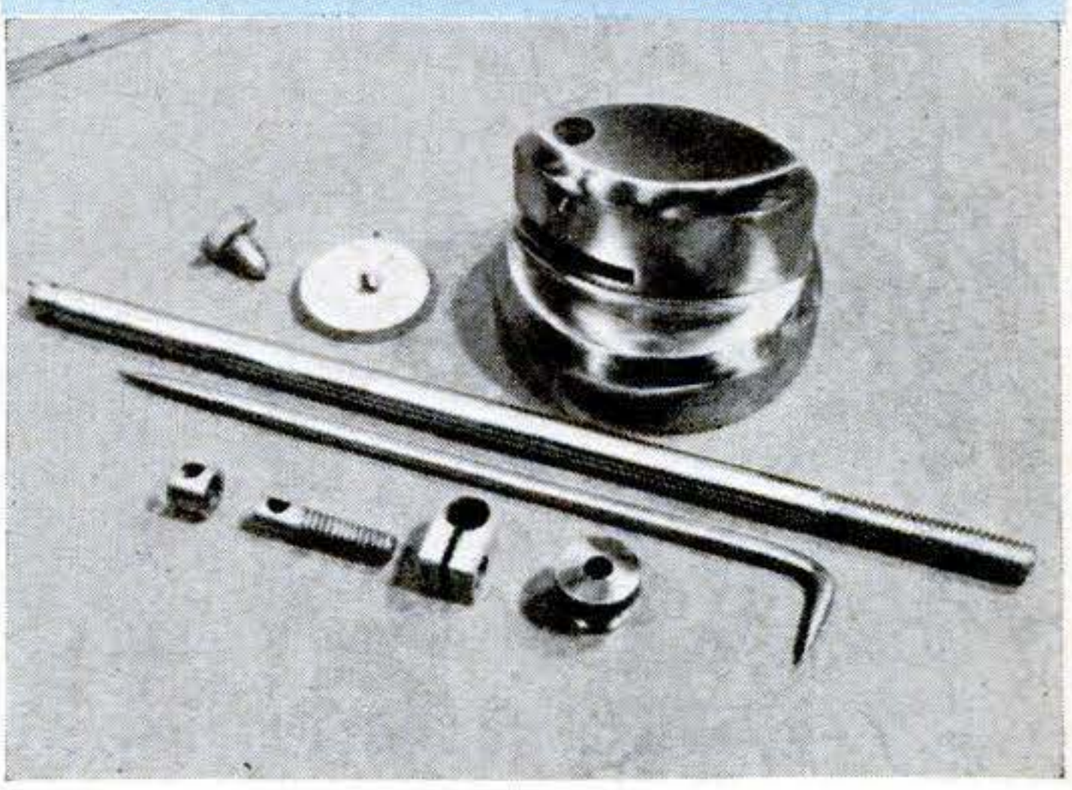
NEW Shop Ideas







Surface Gauge Is Lathe Project. Any modelmaker or machinist needs a surface gauge to scribe layout marks on many work pieces. Making one ordinarily calls for a shaper or miller, but this gauge can be made entirely in your lathe.

Turn the base from a chunk of 2¾″ cold-rolled steel rod. Face the bottom and cut a bevel ¾″ up from the bottom surface to form the round part of the base. Then chuck the base 13/16″ off center in a four-jaw chuck and turn one-half of the elliptical upper part. Loosen two jaws slightly and rotate the base 180° in the chuck to turn the other half of the ellipse. Drill holes for the spindle and setscrew and cut a 3/16″ slot for the adjusting nut. Use a milling attachment to cut this slot parallel with the bottom, or else cut it with a hacksaw and file it smooth.

Turn the clamp screw, sleeve, spindle and knurled nuts from short pieces of cold-rolled rod. After threading the spindle, cut a V groove in it by forcing a threading bit laterally along its side while it is in the lathe. Clamp the bit on its side in the tool holder and make several passes until the groove is ⅛″ deep.

Make a 3/16″-diameter hook scriber from a 6″ length of drill rod. File the scriber clamp from a small block of mild steel, leaving only a thin wall around the spindle hole so it will spring easily when the clamp nut is tightened to lock it on the spindle.

Slip the adjusting nut in the slotted base and twist the spindle down into it. Screw the pointed setscrew into the tapped hole in the base and turn the spindle so that the point of the screw enters the V groove, preventing the spindle from turning.

In use, set the gauge to the approximate height by sliding the scriber up or down the spindle on its clamp. Then make the fine adjustment by rotating the adjusting nut to move the spindle up or down, bringing the scriber into the precise setting desired.—*Will Thomas, Buffalo, N. Y.*

Please turn the page for more shop tips.

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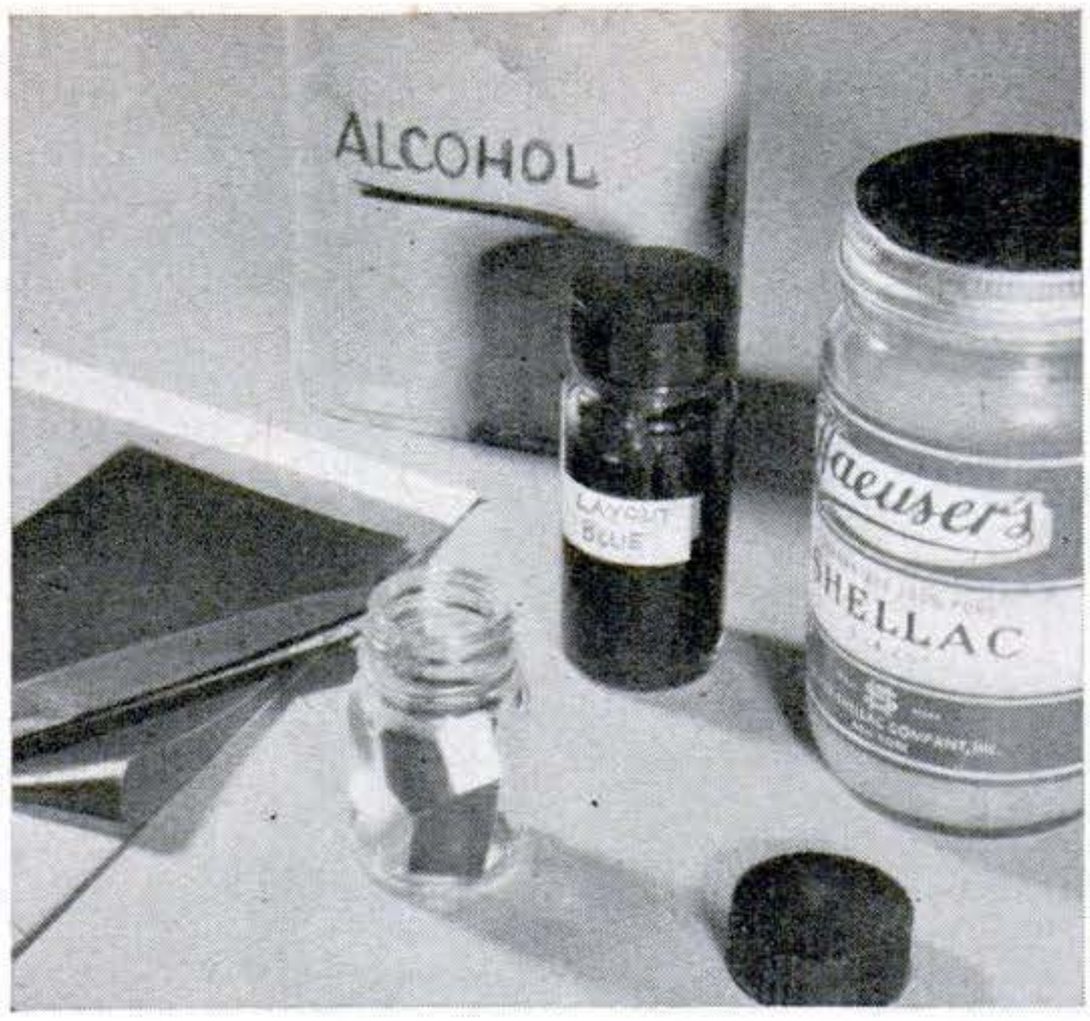
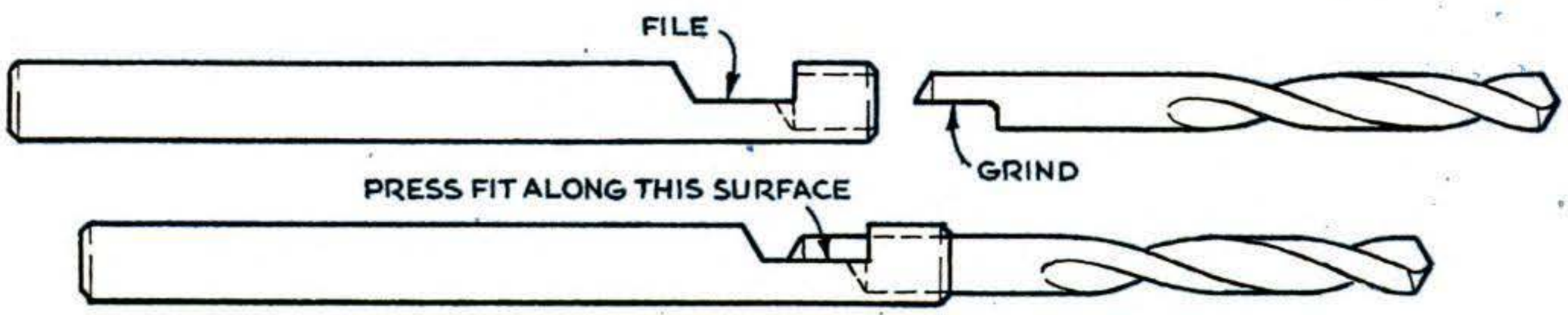
MORE SHOP TIPS

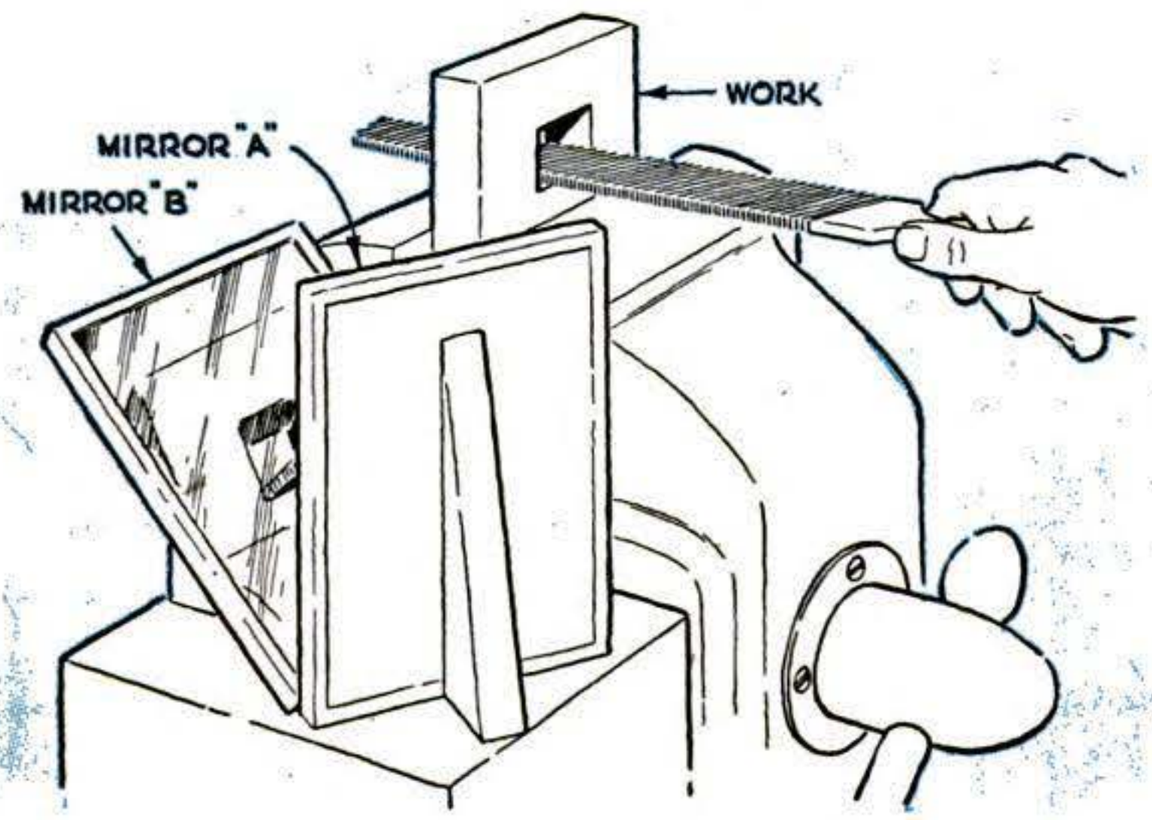


Screw Head Countersinks Inside Holes. Cut off half the head of a flathead steel wood screw and chuck it in an electric drill to make an improvised tool for countersinking holes in hard-to-reach places. No clearance angles are needed; the tool acts like a scraper, producing a smooth countersink. It will work well on brass and aluminum, but should be case-hardened for other metals. *—John J. McGuckin, Ridgewood, N. J.*

Make Your Own Layout Blue. Get a sheet of hectograph paper at a stationer's and cut a quarter of it into small pieces. Soak the pieces in 2 oz. of alcohol to dissolve the aniline coating and drain it into a clean screw-cap bottle. Add a tablespoon of shellac to give it body. This solution will dry instantly on metal surfaces, leaving a deep purple film that won't flake off when scribed.*—J. M. Finn, Pittstown, N. J.*



Drill Extensions Are Removable. Grind an offset on the shank end of a drill and fit it into a matching hole drilled in a length of steel rod of slightly larger diameter. File away half the rod just above the hole to engage the offset on the drill shank. This way, your drills can reach into hard-to-get-at places and still be available for regular drilling operations.*—Fred Barker, Ilion, N. Y.*



Mirrors Ease Filing Operations. Instead of stooping frequently to check your progress when filing to a line, arrange a pair of mirrors beside the vise to reflect the image of the workpiece up to you. Mount the mirrors on a block of wood so that mirror A reflects the image to mirror B, which then reflects it upward. The image is reversed by the first mirror and re-reversed by the second one, presenting the true image to your eye.*—Federico Strasser, Santiago, Chile.*

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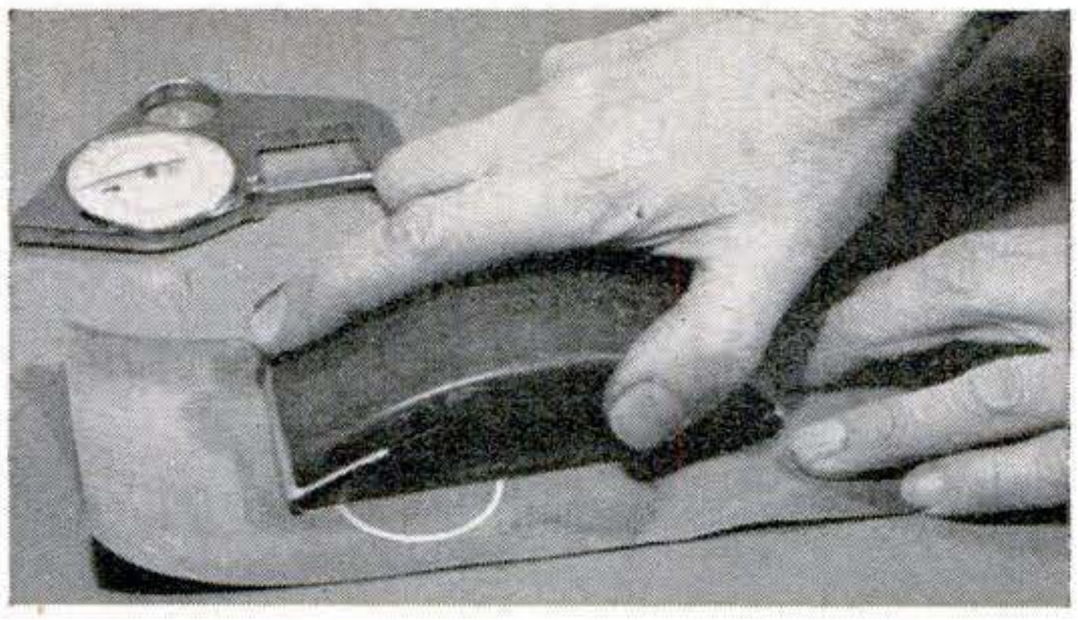
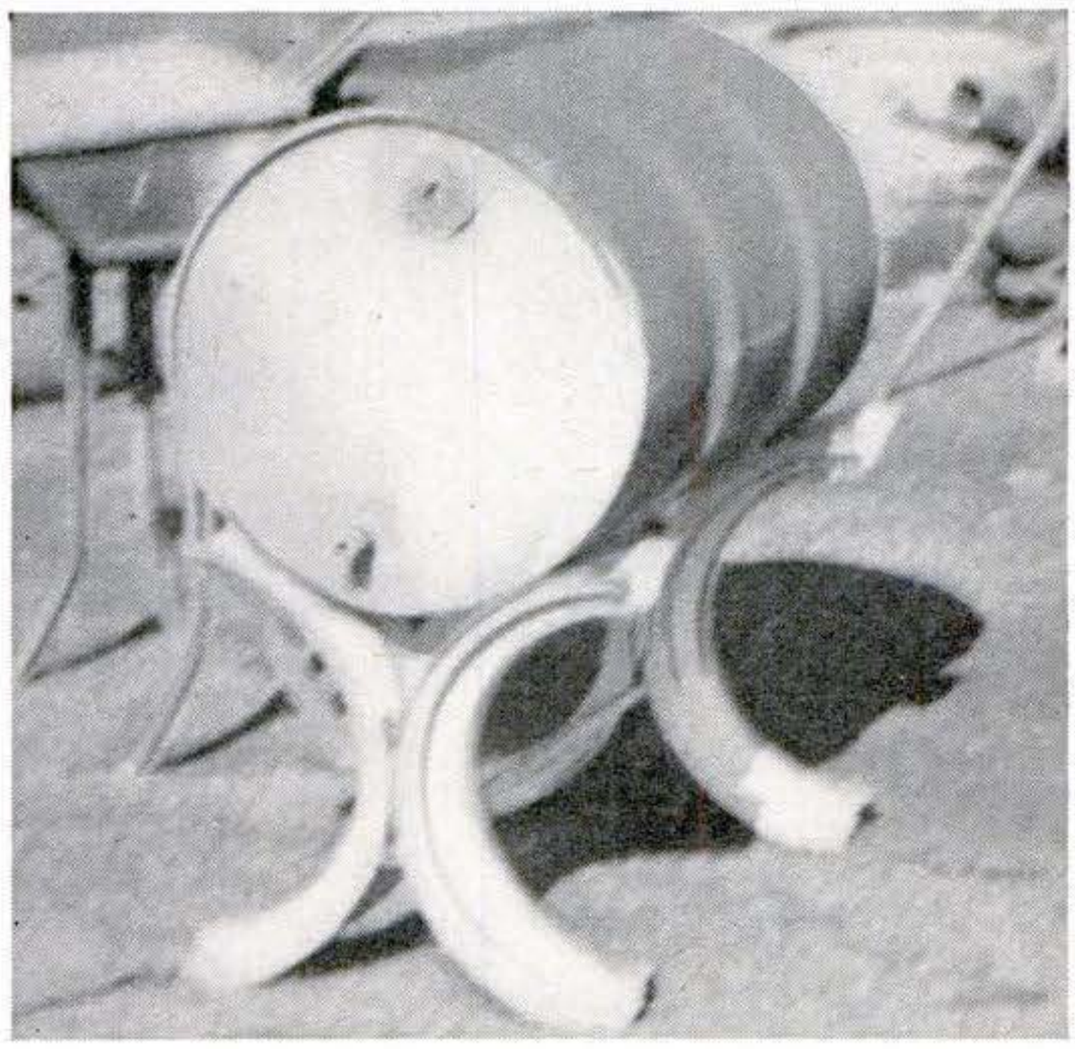


Sanding Thins Down a Washer

IF YOU must reduce the thickness of a washer, spacing ring or similar part by a small amount, place it on a sheet of abrasive and rub with a sanding block. This stunt is also useful for putting a fine finish on flat metal parts used in craftwork.—*Walter E. Burton, Akron, Ohio.*



Tire Rims Support Oil Drum

Two demountable tire rims obtained from an auto junk yard gave me the makings for a useful oil-drum stand.

The rims were cut into two equal arcs. Then the arcs were turned back to back and welded together. The two rim assemblies were fastened by an iron rod welded between them.—*Harry Sloan, Oswego, Kan.*

Alarm Ring Identifies Circuits

UNMARKED fuse boxes can be a nuisance when you want to cut out one of a number of house circuits for repairs. You can save running up- and downstairs by plugging an electric alarm clock into the circuit to be worked on, and letting it ring while you back out the fuses, one at a time. You've got the right fuse when the alarm shuts off.—*Roger Sessler, Jamaica, N. Y.*

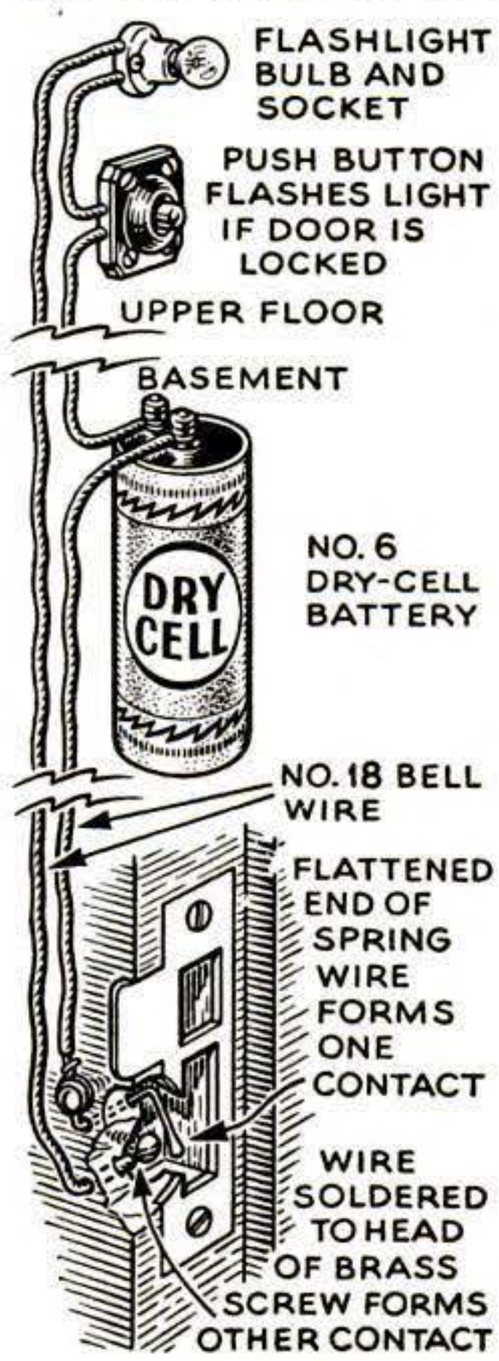
Clock Face Helps Draw Star

THE face of an old clock is a handy aid for drawing a star or dividing a circle into any number of equal parts up to 60.

To lay out the points of a star, place the clock face on the center dot on paper and make a mark every 12 minutes. Draw lines from the center point through these marks and connect them to form the points.—*Ken Olin, Marquette, Mich.*

Is the Basement Door Locked?

WHEN you are closing up the house for the night, do you always wonder whether the basement door is locked? To save myself a lot of steps, I rigged up the push-button checking apparatus illustrated in the sketch. Now all I have to do is push the button at the top of the basement stairs. If the door is locked, the light glows. If there is no light, I know I must go down. A No. 6 dry-cell battery supplies power for the circuit.



If there is a steam or water pipe handy, you won't have to string a second wire to the first floor. Let the pipe do the job.—*W. C. Irving, Silver Spring, Md.*

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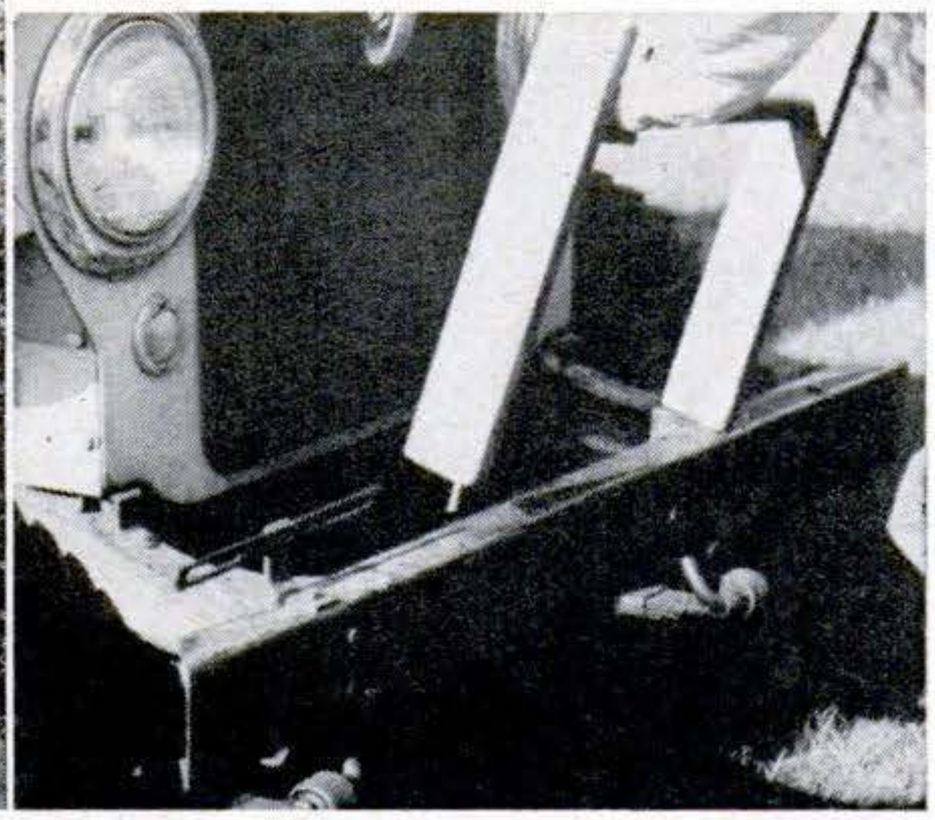
Jeep-Mounted Ladder Gets the Apples

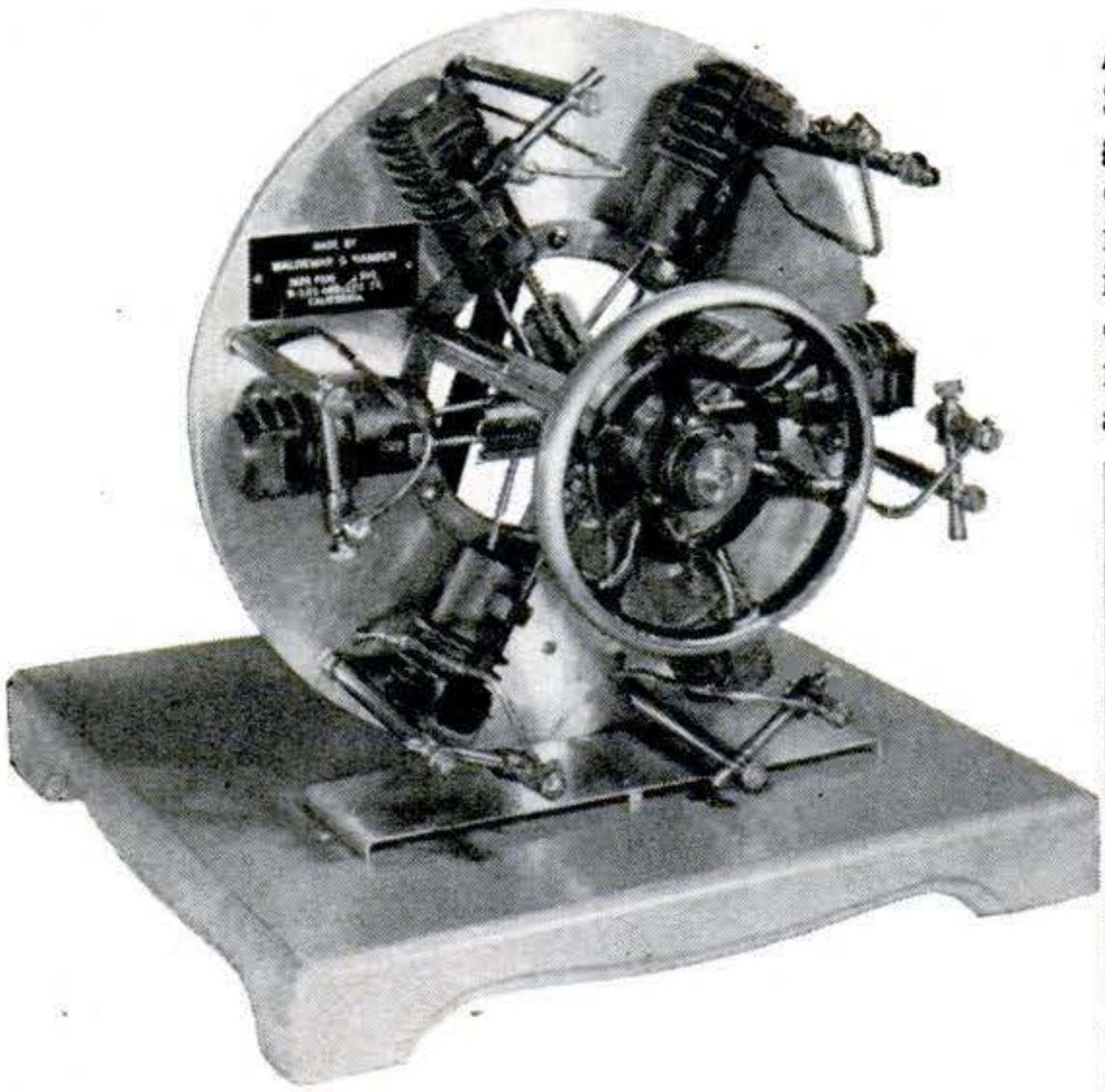
ENGINEERING is Hugh A. Mills' business and he applied its time-saving principles to the job of picking apples on his farm. Putting the ladder on a jeep gets the job done twice as fast.

The ladder feet have prongs that fit in holes in the bumper and are secured by cotter pins. The prongs are just ⅜" lag screws with their heads sawed off and their ends drilled for the pins. Guy wires to the body hold the ladder up.—*Benjamin West, New Canaan, Conn.*

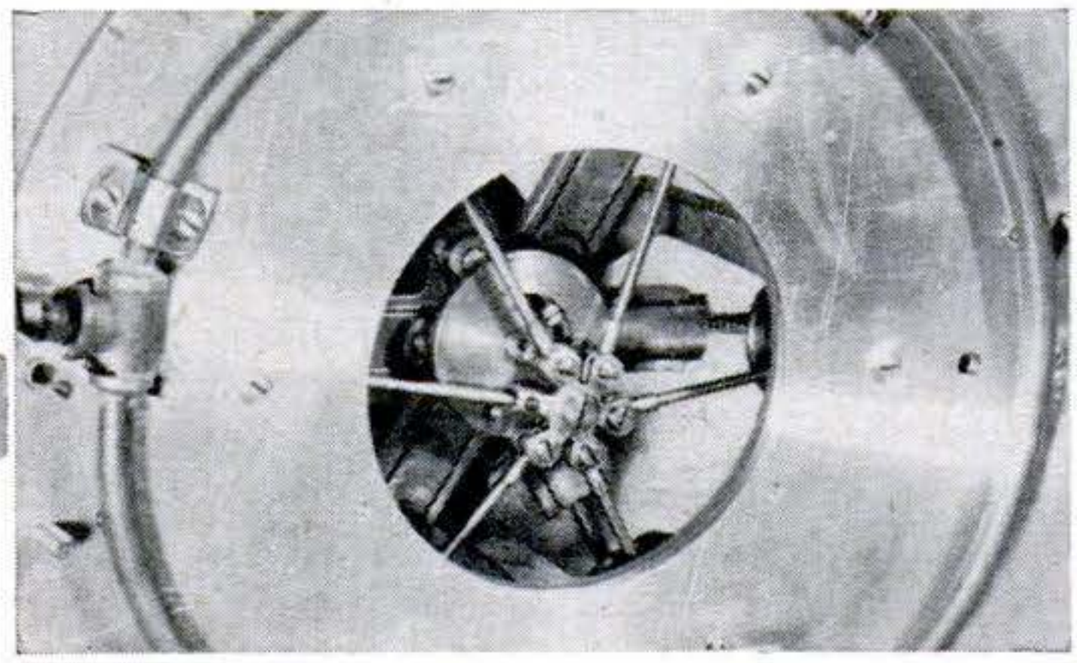


PSM Reader Builds Six-Cylinder Version of Radial Vacuum Engine

TAKING his skills as a machinist home with him to use in his hobby, Waldemar G. Hansen of Los Angeles built five copies of PSM's Mystery Engine (Feb., '50, p. 206). Two cylinders, he thought, would be better than one. So he made a couple of two-cylinder engines of the same kind. His most ambitious project yet is this six-cylinder radial job. It is fired by six gas jets and is said to be instant-starting.



A FLAME BURNS before each cylinder port. Sliding valves, which close the ports after hot gases are drawn in, are driven by a single cam. As gases cool and shrink inside the cylinders, atmospheric pressure drives pistons inward. The flywheel is from a sewing machine. Close-up below shows the six-lobed master connecting rod to which the other five are hinged. Circular pipe carries gas.



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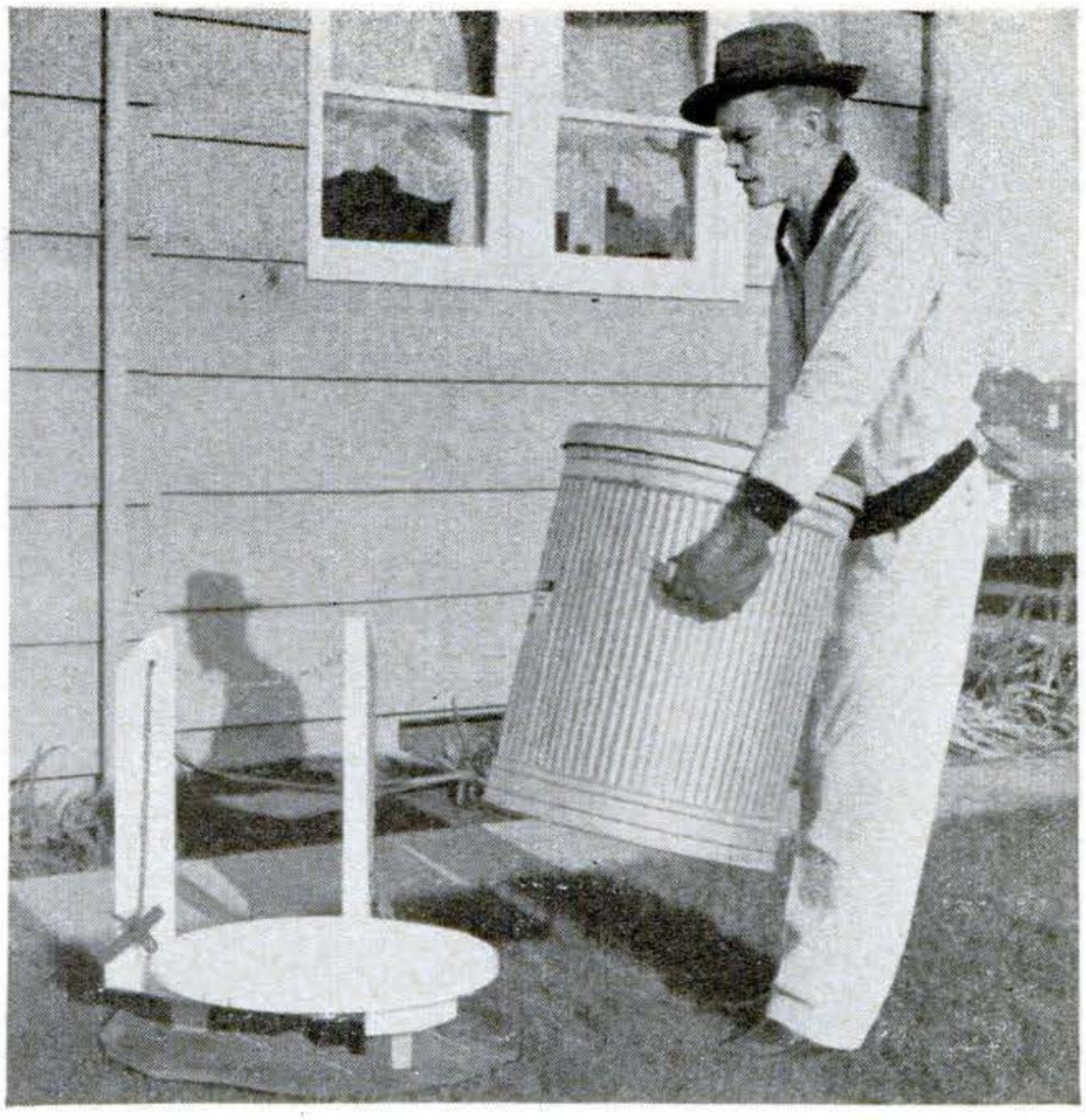
Trash-Can Stand Keeps Yard Neat

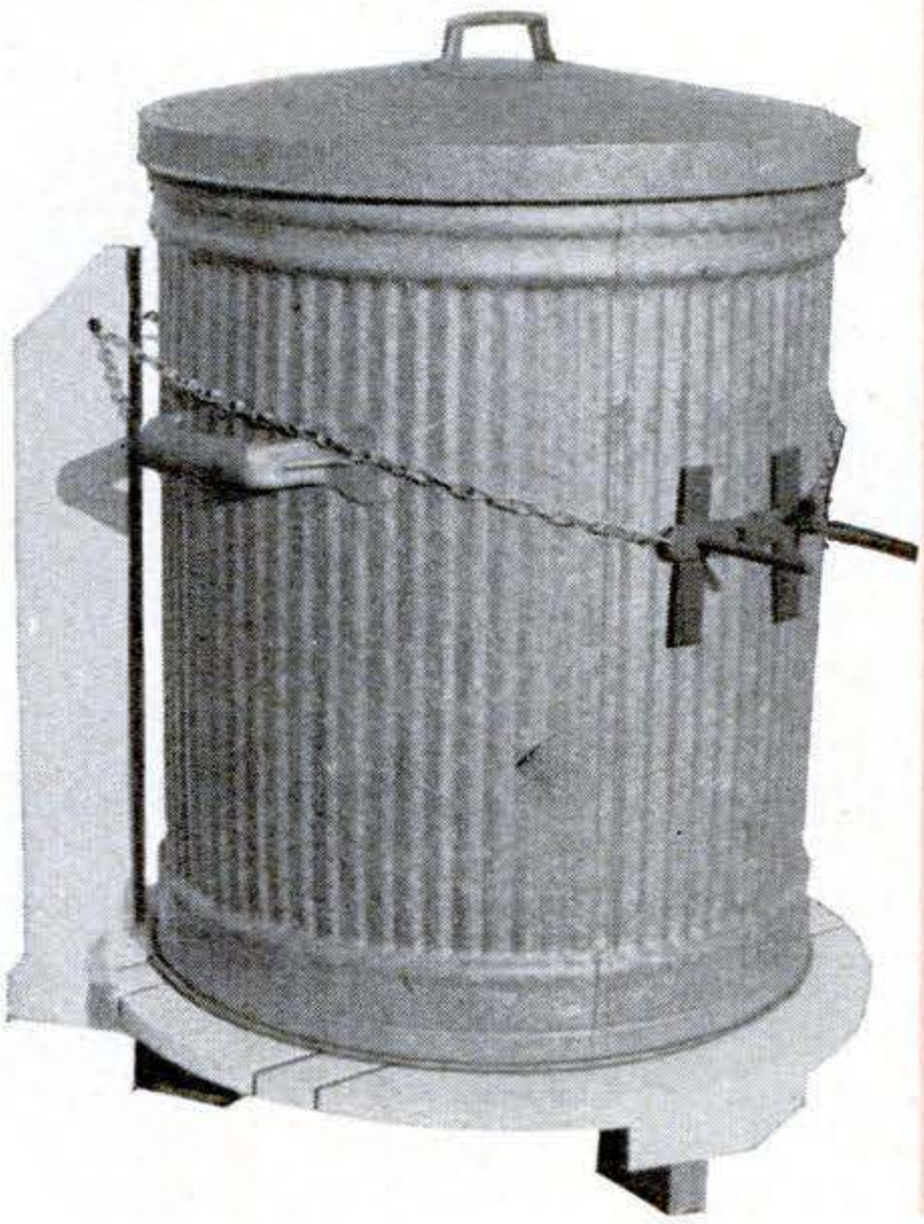


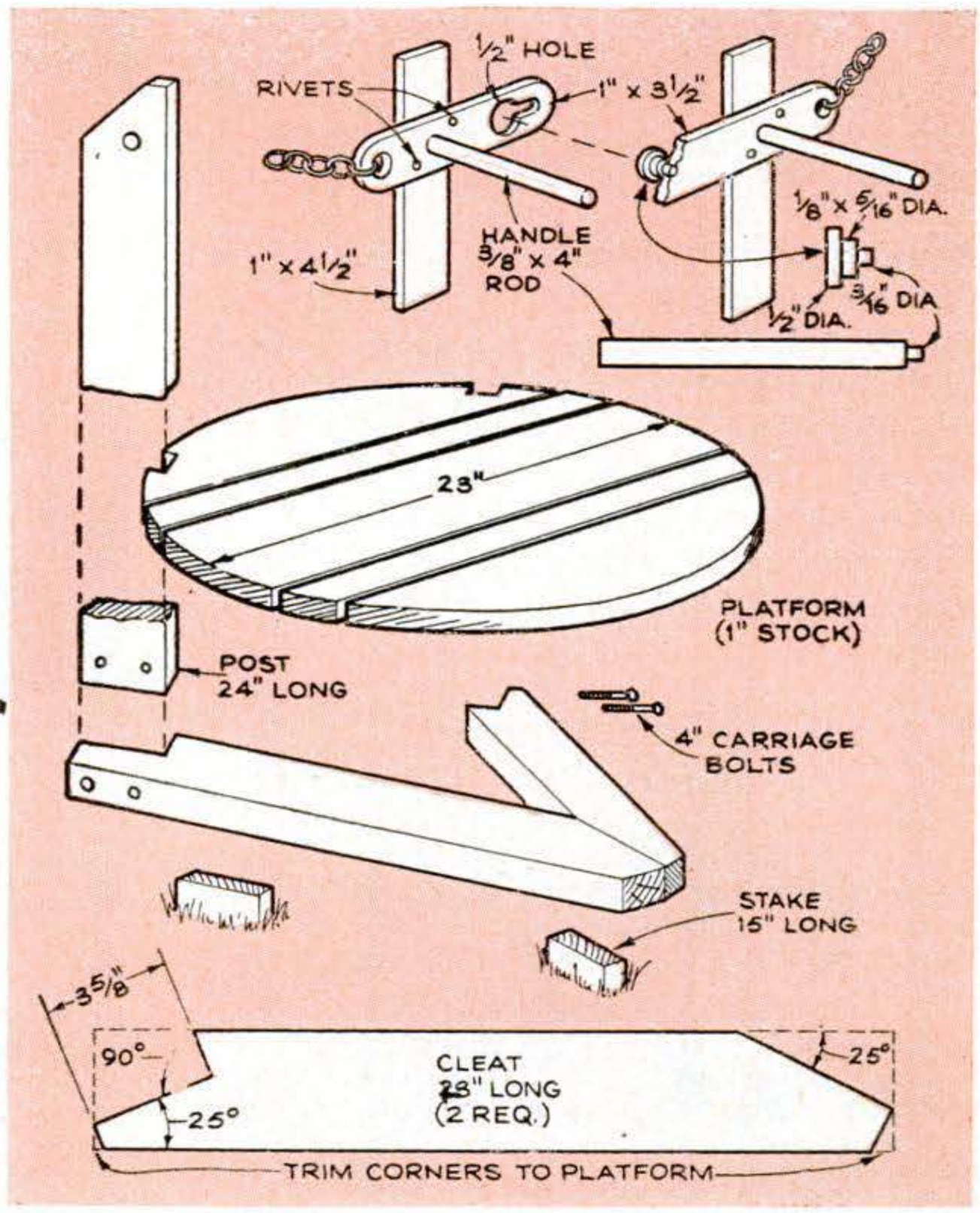
THIS good-looking stand spruces up the back yard, keeps neighborhood pooches from knocking the trash can over, and has a quick-release catch to keep hurried garbage collectors happy.

The stakes, cleats and uprights are all two-by-four stock. Cut the two cleats to shape, and drill holes at each notched end for ½″ bolts.

Drive the three stakes into the ground under the V formed by the cleats, mark the stakes with a level and cut them off square. Fit a 3′ disk of tar paper over the stakes, then nail the cleats on.

Bolt on uprights. Nail random widths of 1″ stock temporarily together, a wide piece outside. Cut the round platform to shape, notch wide piece for uprights, and renail pieces to staked cleats.—*Vern Forsberg, Seattle, Wash.*





Easy-to-Make Fiber Jaws Keep Pliers from Marring Metal Parts

ONE day while working with some small brass pieces it occurred to me that I could use a tool I had never seen—a pair of pliers with fiber jaws. Two bits of red fiber 1/16″ thick cemented to variable-axis pliers gave me exactly the tool I wanted.

Use one of those stick-to-anything cements for the job. To allow for the fiber thickness, open the pliers in the second axis.—*R. L. Clough Jr., Bristol, N. H.*

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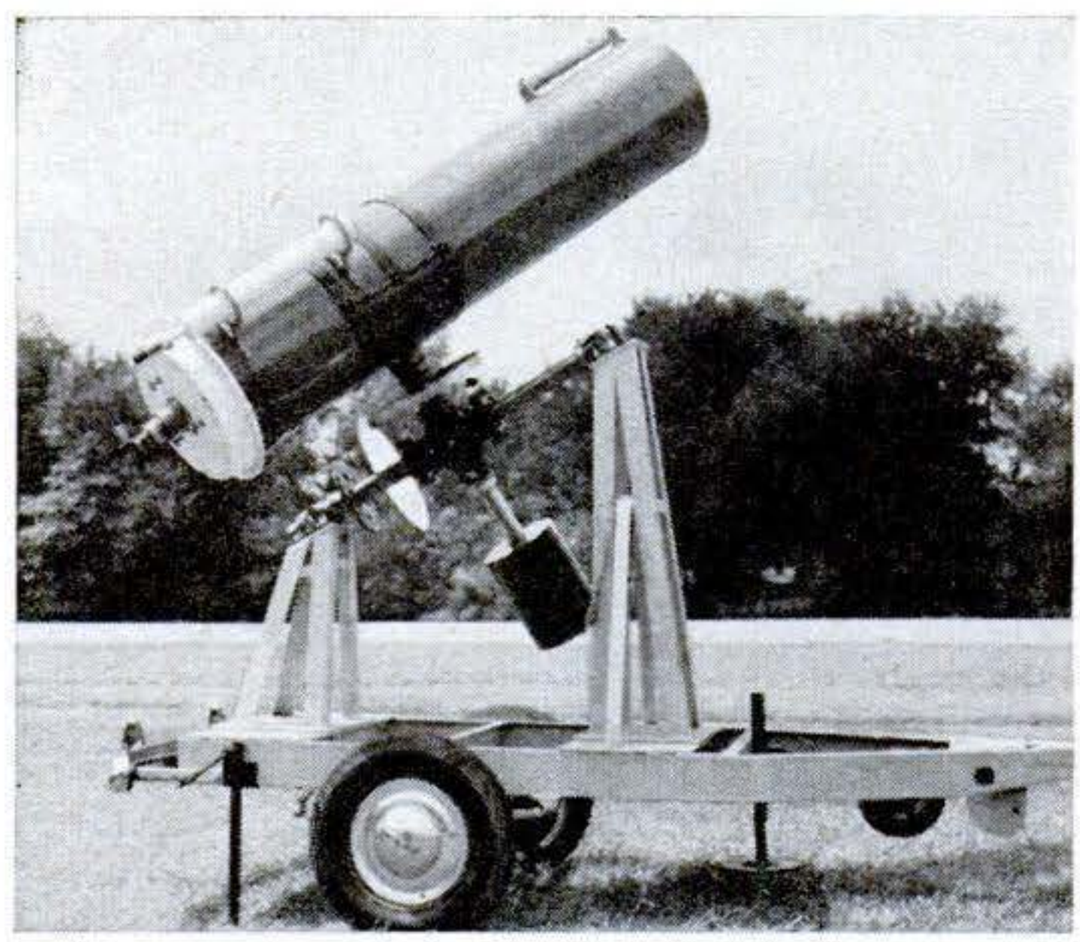
CRAFTSMEN AT WORK

Twin-Hull Boat. One of the strangest, but most comfortable, craft navigating the Portage Lakes near Akron, Ohio, this summer is a motorboat whose twin hulls were once an Air Force bomber's fuel tanks. The boat was built by George Charles of Tallmadge, Ohio.

A 6-hp. outboard mounted between the stern ends of the fuel tanks drives the craft at about 15 m.p.h. A tiller that can be manipulated from the deck provides steering. Hatches give access to the two hull tanks for storage.

Radio in the Cupboard. Radios have found their way into just about everything but the kitchen sink—and below is one that almost made even that. Using parts of three sets, Daniel P. Pomponio of Berlin, N.J., installed the radio in the drawer of his wife's corner kitchen cabinet. An outward-sloping panel allows the tuning push buttons to be adjusted from a standing position. Chrome bars cover the speaker.



Observatory on Wheels. This 20″ Cassegrainian reflector telescope, built by Frank W. Manning of New Orleans, rides to a viewing site on an all-welded trailer. It is then unhitched and leveled by means of three car jacks. An electric drive turns the large gear on the polar axis, synchronizing the telescope swing with star movement.

The 20″-diameter main mirror is a Pyrex disk, 4″ thick. Its focal length is 100″. Six iron disks, totaling 500 lb., balance the instrument on the declination axis. The finder, mounted near the eyepiece, is a 3″ refractor telescope.

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Ever been Stood up...

It's a day you'll never forget. There you stand as the minutes tick slowly by. And somewhere, the car that *was* to have picked you up is stalled.

Any service man will tell you to check your fuel system twice a year. That goes for fuel pumps, too.

If your fuel pump is an AC—and 9 out of 10 are—it's precision-built to keep you out of trouble. But, normal wear can eventually cut down any fuel pump's efficiency. Have it checked—and if there *is* need for replacement, be sure you get an AC Fuel Pump.

YOUR FUEL PUMP needs to be as good as AC builds it . . .

For example, the diaphragm is the hardest working part of the pump. That's why the AC diaphragm is made of *four* strong layers of patented-treatment, square-woven airplane cloth instead of one. AC builds it better to serve you longer.

AC SPARK PLUG DIVISION GM GENERAL MOTORS CORPORATION

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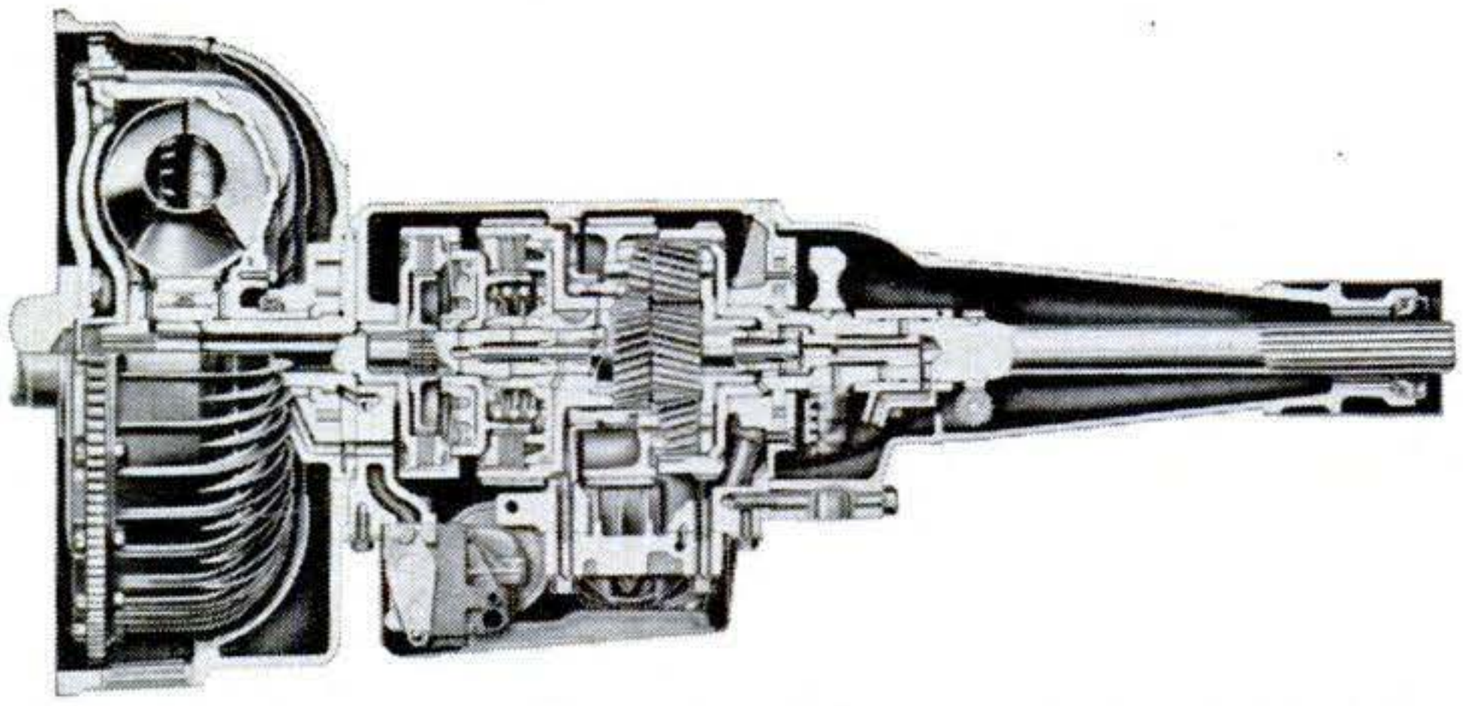
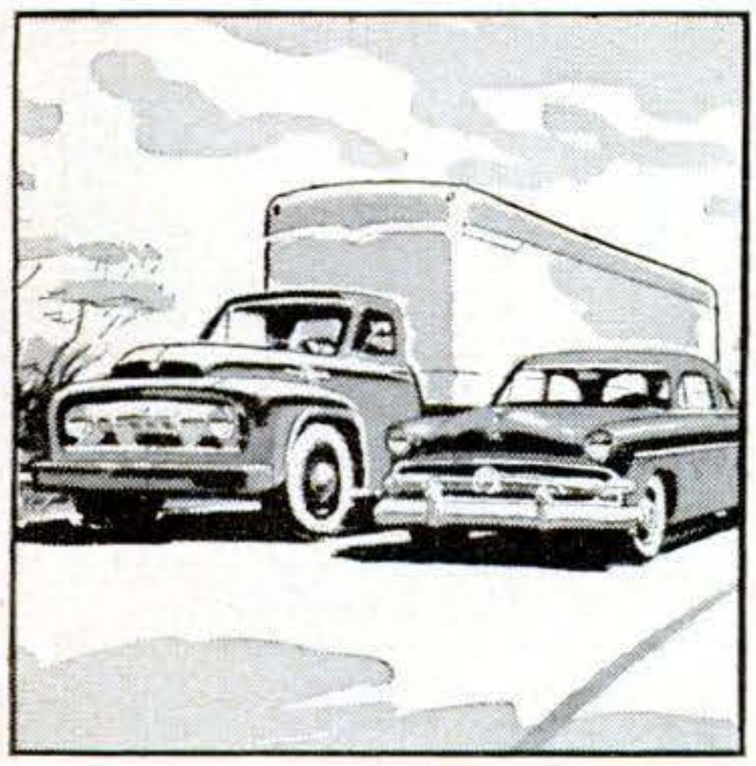
Of all automatic drives in the low-price field:

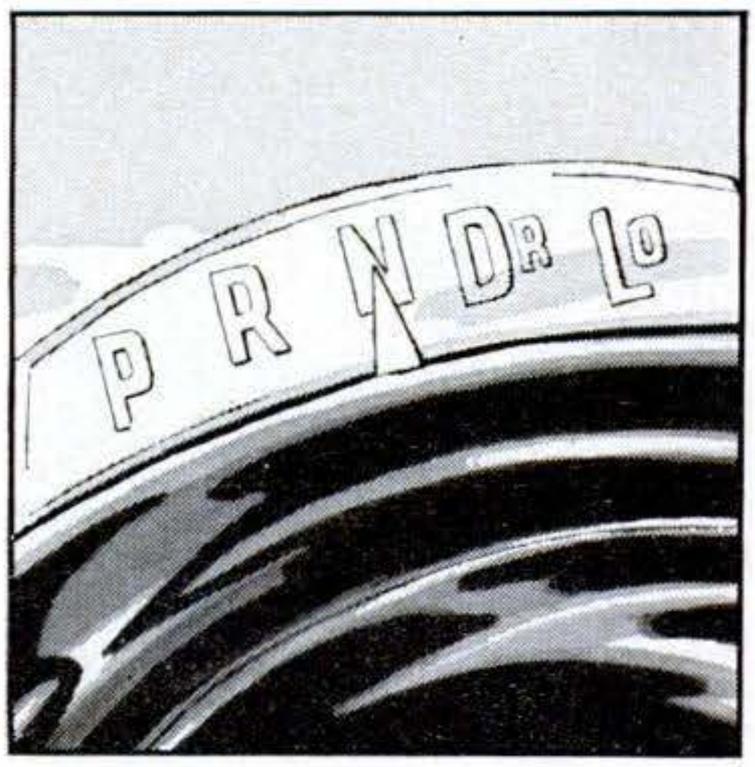
Fordomatic is





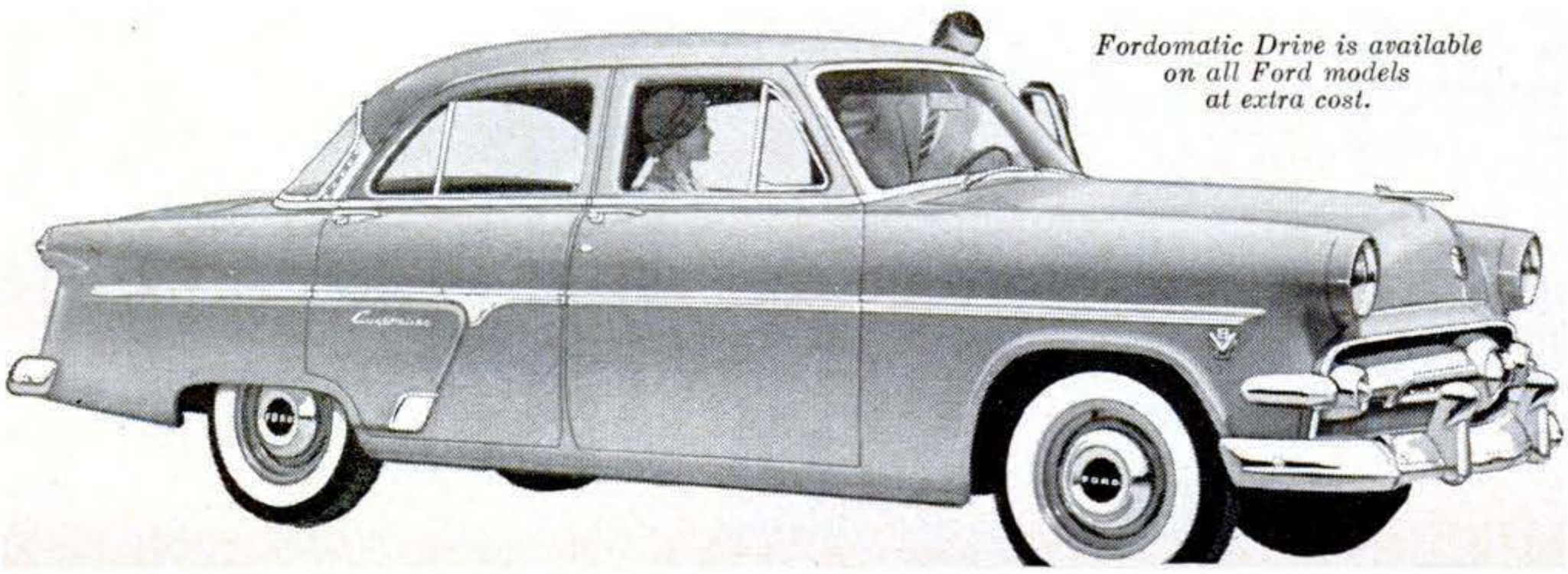
Gives you that extra "Go." Simply press down on the accelerator at any speed up to 58 mph and you get nearly 50% extra passing power with Fordomatic's automatic intermediate gear. Only Ford in its field has it.

Gives you smoother braking down hill. When selector is moved to low at speeds *above* 25 mph, Fordomatic goes into intermediate gear until speed falls *below* 25, then goes into low . . . for smoother, extra-sure braking.



Provides an extra measure of safety. Fordomatic lets you go from neutral to reverse *without* having to pass through a forward drive position. Selector must always be in neutral (N) before starter will operate.

Worth more when you buy it . . .
Worth more when you sell it!



Fordomatic Drive is available on all Ford models at extra cost.

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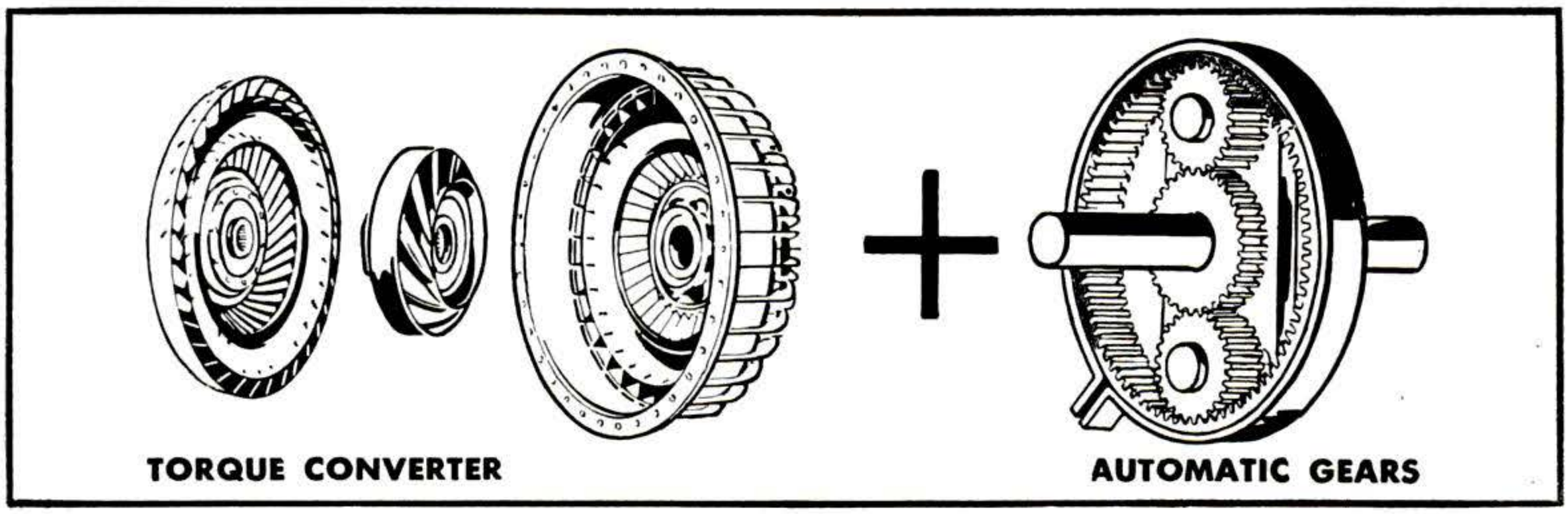
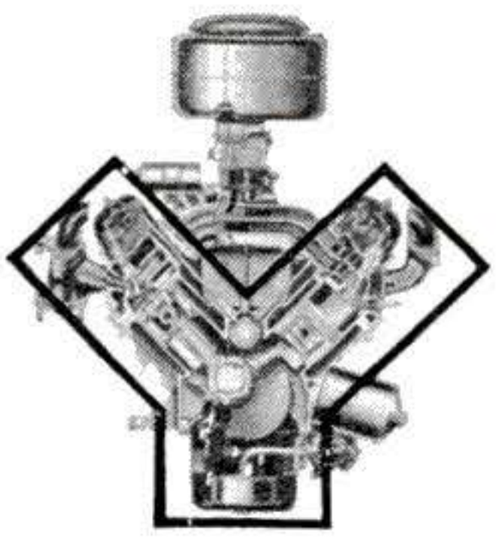
the most versatile

Fordomatic combines a simple 3-element torque converter with a 3-speed planetary gear system to provide the widest range of fully automatic operation!



Fluid torque converter smooths the way. With Fordomatic's torque converter, power is always transmitted to the rear wheels through a "cushion of oil." There is no direct *mechanical connection* between engine and rear wheels. So you get smooth operation with a minimum of wear.

Mechanical gears widen operating range. Starts in DR range are through automatic intermediate gear which combines with converter to multiply torque as much as 3.11 times for fast, smooth starts. For unusual conditions, selector may be set at Lo to multiply torque up to 5.13 times!



Choose the only V-8 in the low-price field! Team Fordomatic with the industry's most modern engine—the new 130-h.p. Ford Y-block V-8—and you have the smoothest, most versatile automatic "power package" in the low-price field. Deep-block, low-friction design spells smoother going, more "Go" per gallon and longer life.

Your Ford Dealer cordially invites you to Test Drive the

FORDOMATIC Ford

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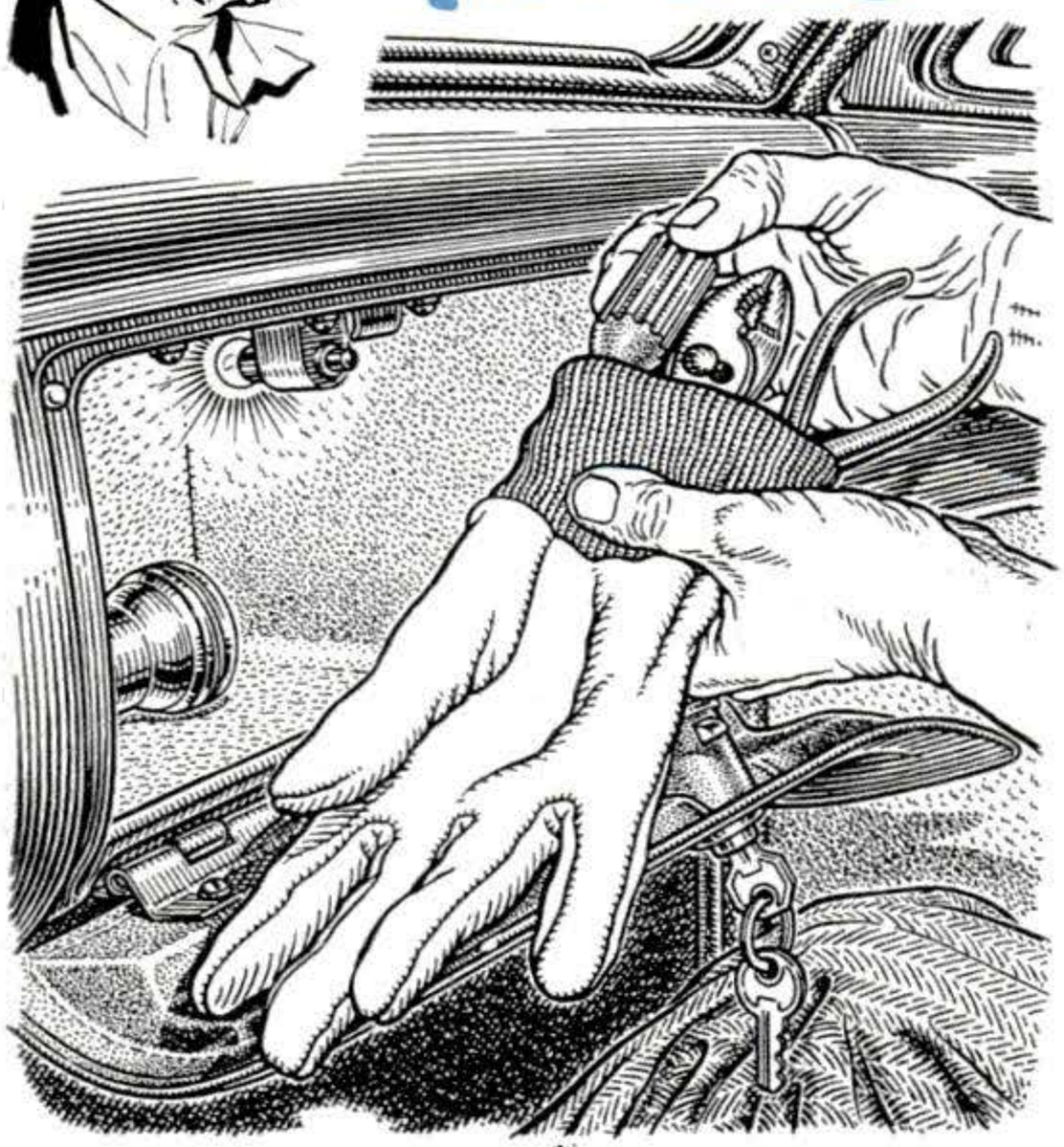
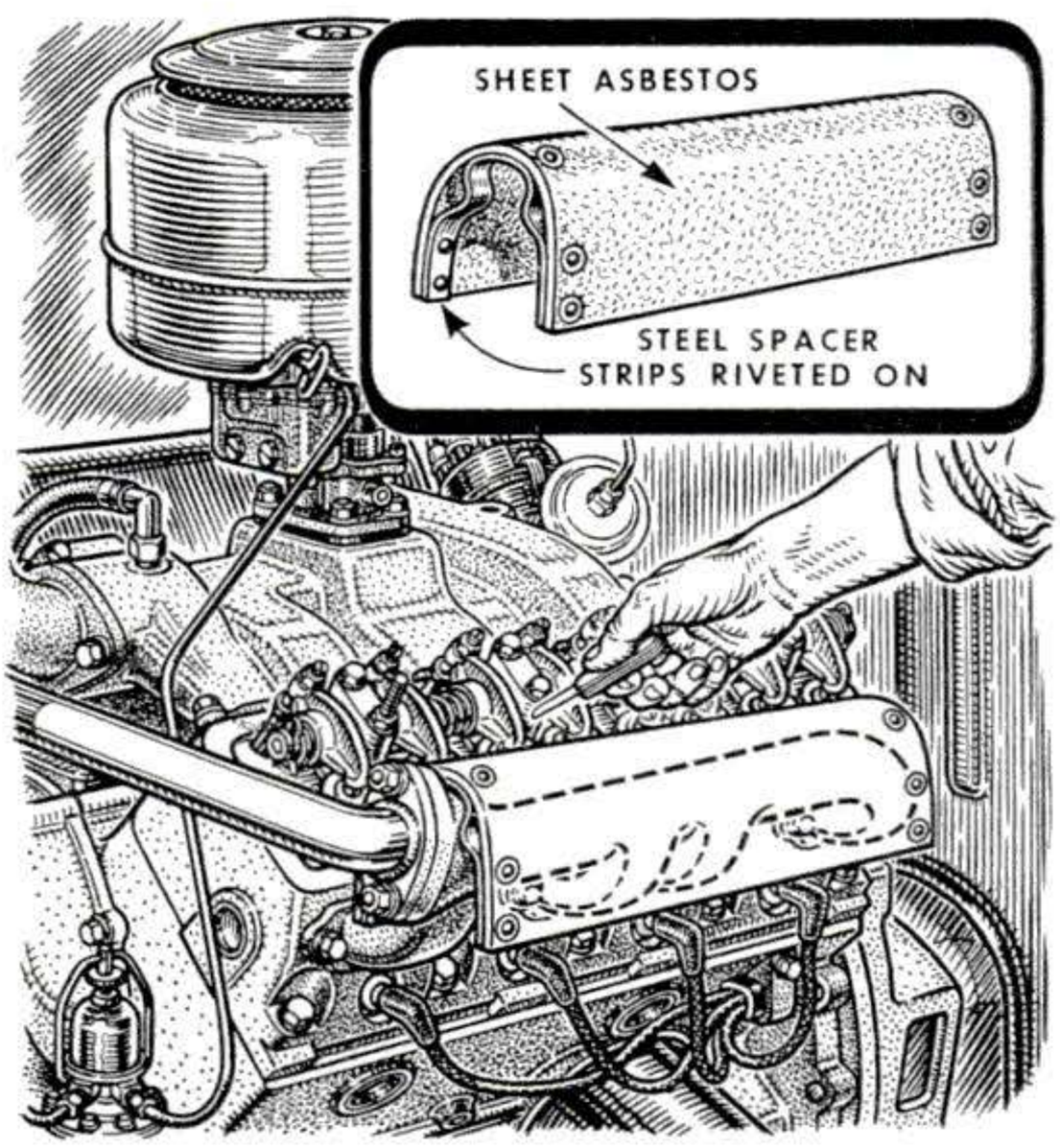
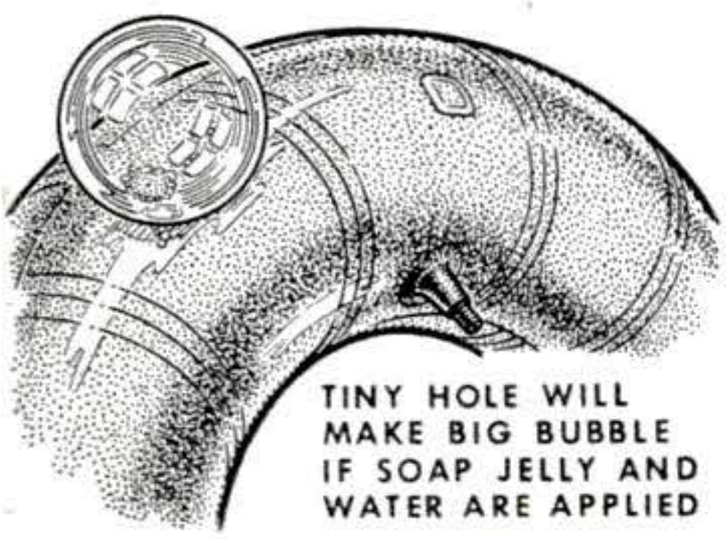
Hints FROM THE MODEL GARAGE



Keep small tools from rattling in the glove compartment by storing them in the fingers of a pair of work gloves. Then, if you must make an emergency repair, you can lay out the tools and don the gloves to protect your hands from grease and dirt.



Make an asbestos shield to keep your hands from being burned by a hot manifold when tuning or adjusting an engine. Cut sheet asbestos to fit over the exhaust manifold and rivet steel strips to the ends to clip the shield in place.



Soap for everything. Keep a bar of soap in your car's tool kit—it has many uses: Lubricate a bolt with it when grease or oil would cause a stain; rub it on an inner tube to help locate a leak; slide a hose on a fitting without effort by rubbing soap on the inside; or lubricate a tire bead with it to make tire-changing easy. Rub soap over your hands, too, and in your nails before starting a job—washing will be easier later. Soap jelly, made by dissolving small scraps in a jar of water, is especially easy to apply.

 Please turn to page 218 for more auto hints.

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KNOW-HOW

GET IT — AS AN AIRMAN

- This Airman is using "know-how" to guide this plane to a safe landing. He got it in the Air Force and it will serve him *anywhere!*
- "Air Force know-how" is the result of top job training at the finest technical schools. Here you can learn anything from Control Tower Operations to Jet Mechanics—from Personnel Management to Printing and Communications. There are over *400* valuable courses available.
- And the job you learn is one you can be happy with—because it's selected scientifically for you by guidance experts who carefully consider your interests, capabilities and the needs of the Air Force.
- Make "Air Force know-how" *your* way to success. Insure *two* futures—your country's and your *own*—as an Airman!

STUDENTS! If you are still in school, graduate before you enlist!

U.S. AIR FORCE

PERSONNEL PROCUREMENT DIVISION PS2
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Washington 25, D. C.

Please send me more information on my opportunities as an Airman in the U.S. Air Force.

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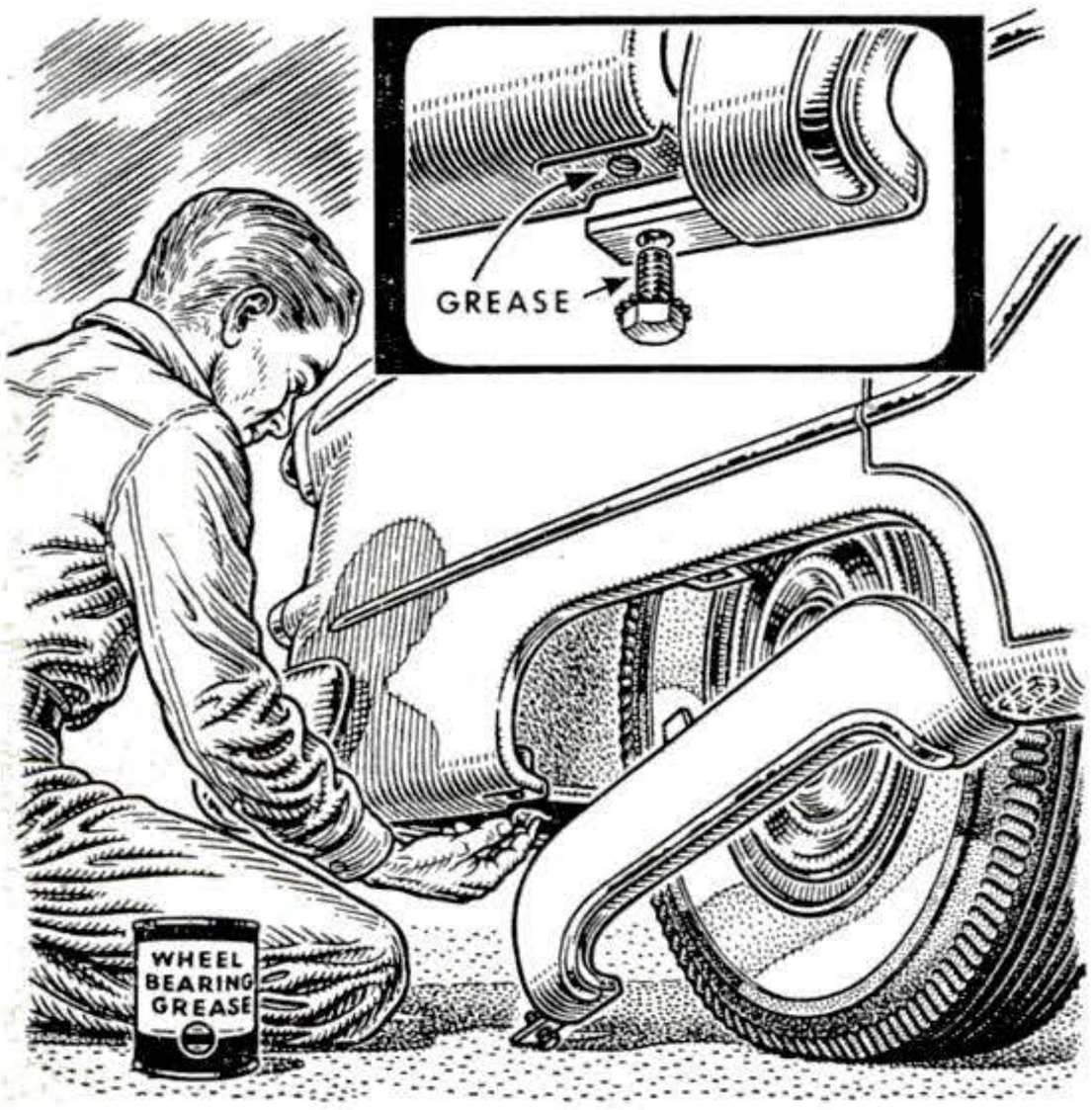
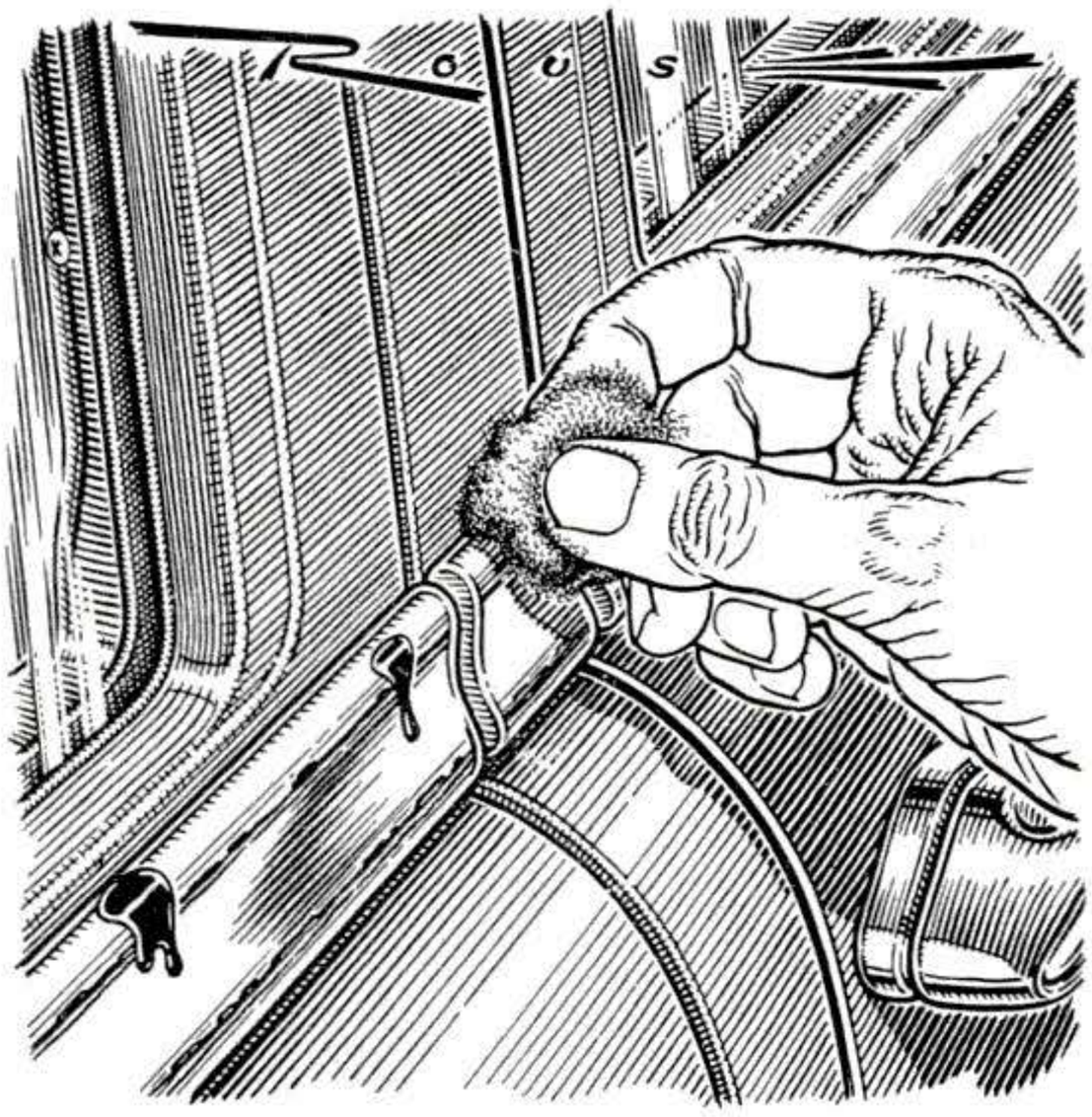
MORE Hints from the Model Garage

Improvise a coat-hanger bracket by closing a rear window tightly on a rubber fruit-jar ring. The ring will support several garments on hangers and will leave no marks or scratches on the window. A ring cut from an inner tube will serve as well.

Calibrate an old coffee pot for use as an oil measure by filling it a pint at a time and punch-marking the side to the level reached as each additional pint is poured into it. Make the punch marks crisp enough to be clearly visible from the inside.



Make fender skirts easy to remove by coating the lock bolts with heavy wheel-bearing grease to keep them from rusting. Skirts are bolted on many late-model cars and it is almost impossible to remove a rusted-tight nut without twisting or otherwise damaging the fender.



Clean paint off chrome trim or rubber moldings with steel wool, after doing a touch-up or spray job on the body. Wind the wool around a stick if the area is small or hard to reach. This way, you won't put scratches on the trim as you might with a knife or scraper.

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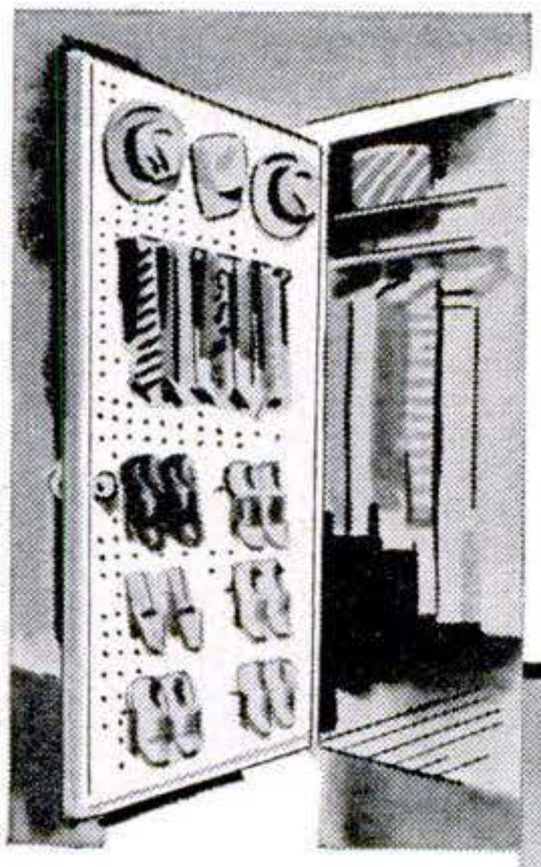
Three types of Upson Panels are used to finish this striking recreation room. See below for details.

Ideas for weekend remodeling

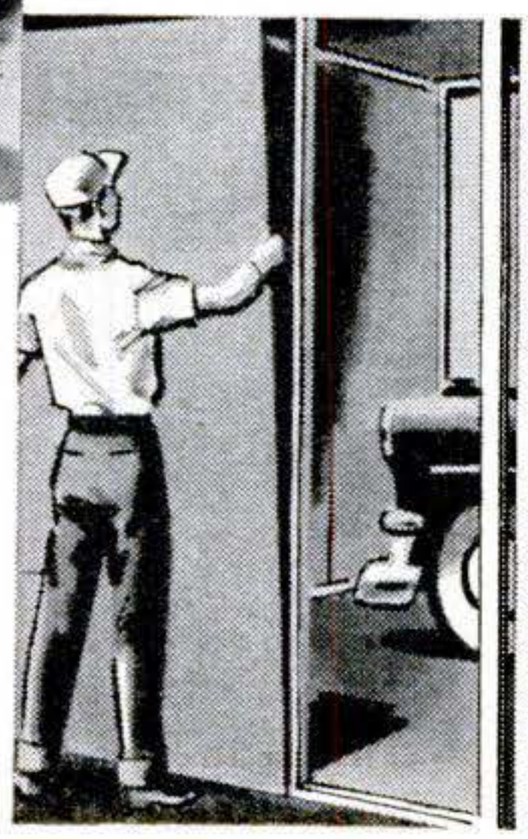
with **UPSON** DO·IT·YOURSELF **PANELS**



Upson makes a complete line of Panels for remodeling your home. In the recreation room pictured above for instance . . . the ceiling is covered with Upson Ceiling Tiles, washable, durable, attractive. The wall behind the bar is stunning Upson Striated Paneling, easy to apply, easy to paint. The far wall is Upson Strong-Bilt Paneling, permanent, crackproof, adds lasting beauty. The bar . . . sawed squares of Strong-Bilt with beveled edges.

See your lumber dealer and look over every Upson Panel type. Insist on the name "Upson" for top quality material.

For full details, *mail coupon today!*



↑ Idea. Cover inside of closet doors with Upson Peg-it Panel. Makes handy storage space.

→ Upson All Weather Sheathing, heavy duty, waterproofed, perfect for siding a garage.

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☐ Please send FREE details on _____
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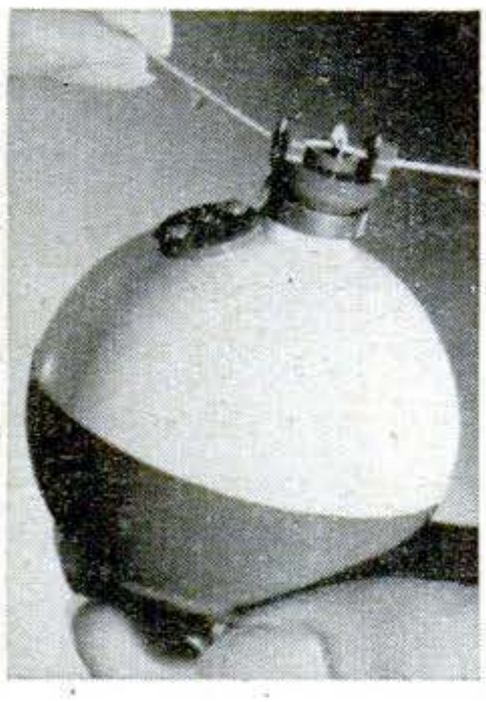
Rod and Tackle Fans Get New Crop of Aids for Reeling in Big Ones

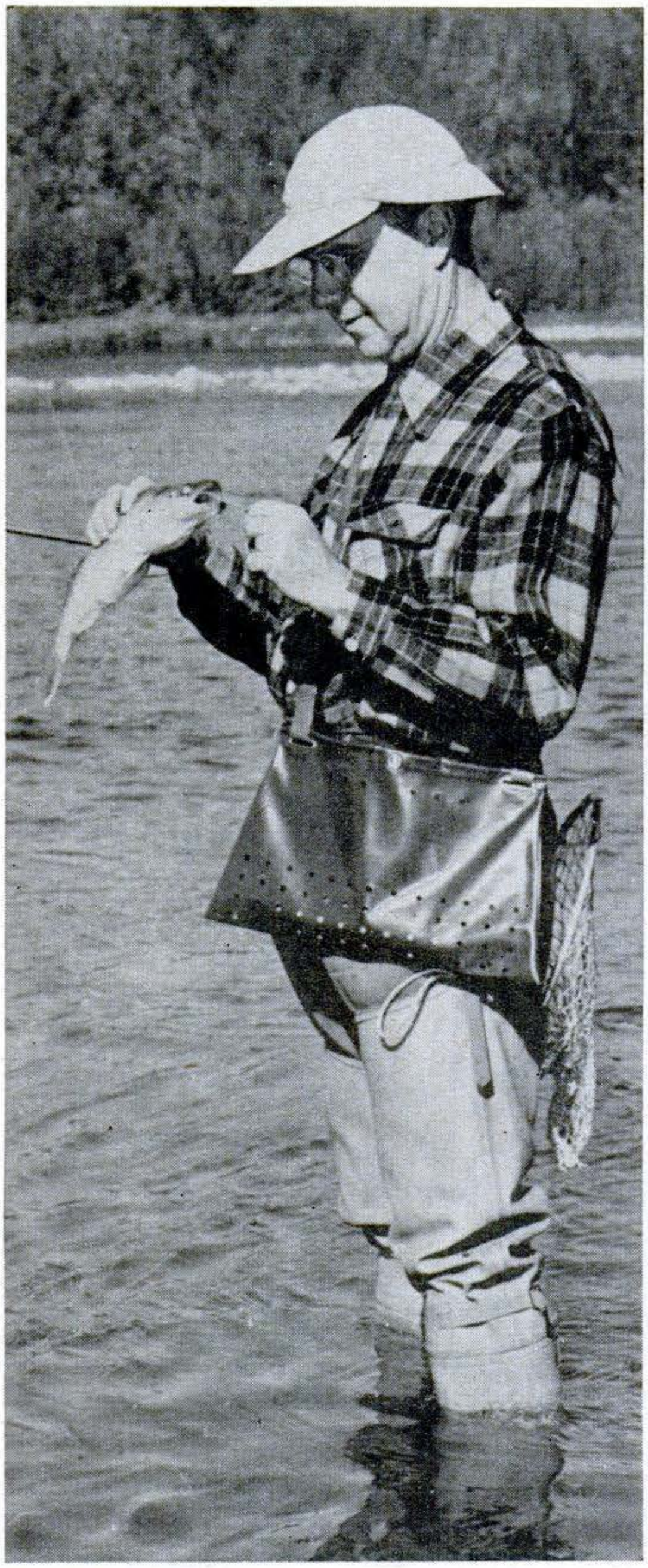
1. Fish scaler takes the mess out of a mess of fish by preventing the scales from flying in all directions. It catches them in a cup-like cover, then rinses clean in hot water. The scraping teeth are cadmium-plated to make them rustproof and the scale-trapping cup shields the blade for safety when the Scale-Catcher is in use or carried about in the fisherman's pack. The scaler is sturdily made and odor-resistant.

2. Fishing-rod case of toughened plastic will withstand the shock of a 200-pound man jumping on it; won't warp, dent or corrode. Two inches in diameter, the case will hold two fly rods or two or more casting-rod tips and most spinning rods. The longest size—55 inches—weighs only 16 ounces.

3. Casting buoy, threaded on fishing line, locks into position a few seconds after alighting on the water. An adjustable control valve lets you set the timing on the locking device and the automatic action allows bait to be raised or lowered at will as you fish. Upon retrieve, the casting buoy is automatically unlocked.



4. All-in-one reel eliminates the rod and gives you one piece of gear for spin-casting, trolling, drop-line fishing and crabbing. A sensitive brake on the rodless reel gives control of fish and line and its fast retrieve—1½ feet per turn—should land more fish. The reel is lightweight and easy to use.



5. Washable creel loses fish odor when dunked in suds. Big enough to take a 16-inch fish without bending, it has plenty of air holes to keep a catch fresh and cool.

Further information on these products can be obtained from: 1. Mercury Plastics Co., 20787 Mound Road, Van Dyke, Mich.; 2. Dumont Corp., 23 Bay St., San Rafael, Calif.; 3. Coughlin Specialties Co., 579 Drexel Ave., Detroit 15; 4. Reel-Easy Corp., P.O. Box 1093, North Station, Arlington 7, Va.; 5. Hawkeye Tackle Products, Inc., Dexter, Mich.

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SKI-HI STILTS FOR KIDS OF ALL AGES

Two lengths of Reynolds *Do-It-Yourself* Aluminum tubing and one piece of bar stock are the necessary materials. You can turn it out in very little time by following simplified directions outlined in Easi-Bild Pattern No. 552.—25¢ with coupon

HOW TO GIVE YOUR HOME PROJECTS THIS PROFESSIONAL LOOK!

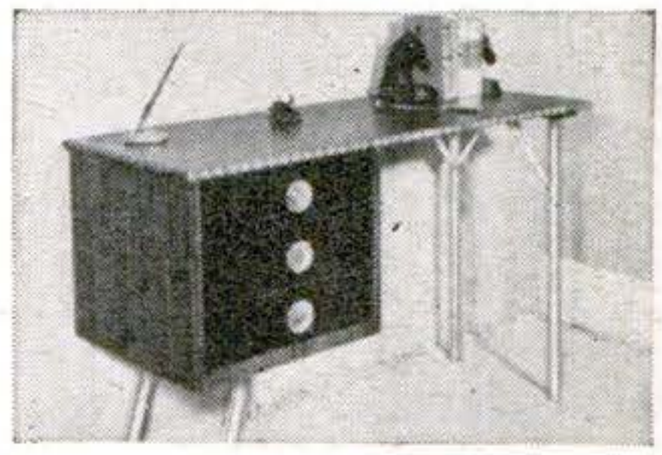
...make them yourself with Reynolds *Do-It-Yourself** Aluminum using standard hand or power tools

You can turn out project after project easily and quickly with this astonishing new material — Reynolds *Do-It-Yourself* Aluminum. You can saw it, plane it, drill it, shape it, joint it and bend it with tools found in the average home. In fact, *all* leading hand and power tool manufacturers approve Reynolds *Do-It-Yourself* Aluminum.

Designed in easiest-to-use forms, Reynolds *Do-It-Yourself* Aluminum comes in sheets, tubing, rods, bars, angles, storm sash, screen sections and handy fasteners.

Caution! Use only Reynolds *Do-It-Yourself* Aluminum. Identify before you buy — there's a special Seal on every piece to tell you it's Reynolds *Do-It-Yourself* Aluminum.

African Primitives add Decorator's Touch. Reynolds Do-It-Yourself embossed Aluminum simplifies making. Can be cut with scissors. Easi-Bild† Pattern No. 539. —25¢ with coupon



Make this Decorator's Library Desk. No special skill or experience is needed to build this smartly styled desk. Anyone can build it by following Easi-Bild Pattern No. 537. —50¢ with coupon

Porch, Game Room, Terrace Table and Modern Web Chairs. Top is made from heavy stock lumber, held together with aluminum tubing. Easi-Bild Pattern No. 554—50¢ with coupon. Web Chairs, Easi-Bild Pattern No. 548. —50¢ with coupon

Look for this handy self-service display rack at your Hardware or Department Store or Building Supply Dealer's without delay. And give your home projects the *professional look* with Reynolds *Do-It-Yourself* Aluminum.

*T. M. REYNOLDS METALS COMPANY
†T. M. REG. EASI-BILD PATTERN COMPANY

REYNOLDS DO-IT-YOURSELF* ALUMINUM

REYNOLDS ALUMINUM SERVICE CORPORATION
2494 South Third Street, Louisville 1, Kentucky

Please send me the following PATTERNS and free booklets (check as desired). I enclose $..... in money order or coin. (No stamps, please.)

- ☐ Easi-Bild Pattern #537 for *Decorator's Library Desk*.....50¢
- ☐ Easi-Bild Pattern #539 for *African Primitives*.....25¢
- ☐ Easi-Bild Pattern #554 for *Terrace Table*.....50¢
- ☐ Easi-Bild Pattern #548 for *Web Chairs*.....50¢
- ☐ Easi-Bild Pattern #552 for *Ski-Hi Stilts*.....25¢
- ☐ How-To Booklet containing general instructions.....FREE

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Reynolds *Do-It-Yourself* Aluminum is also available in Canada

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[*Continued from page 75*]

solar-power supply for charging storage batteries.

As it sped over the poles at its dizzy speed, our new moon would look something like an apple on a stick, with the stick pushed through to poke out at either end. These protruding sticks would be made of cast-aluminum tubes and serve as antennas; they also would contain various instruments such as gamma-ray, cosmic-ray and aurora counters.

A window, made of special filter glass, in the MOUSE's skin would let through only solar ultraviolet rays, another of beryllium would admit only solar X rays.

Data Would Be Recorded on Drum

How would the satellite send back to earth all the information gathered by these counters and instruments? Continuous radio communication would soon drain the solar electric supply. So, to save power, the MOUSE would store up its information and record it on a magnetically coated drum. This hoarded information would be transmitted only twice during each orbit, at the most advantageous points, the poles. There communications planes or ground observers would radar-trigger the MOUSE's transmitter so that it would send out in 30 seconds all the data it had collected in the previous 45 minutes.

This would be done by recording with the drum moving at 1/30 of an inch per second, using 7½ feet in 45 minutes. The playback, at a speeded-up three inches a second, would take only 30 seconds.

Vapor Trail Visible from Earth

Would you be able to see the MOUSE as it sped 200 miles over your head? Not normally. But it could be arranged. Either the MOUSE itself, or the burned-out third rocket that came tumbling after, could exhaust a sodium-vapor trail. This, when hit by bright sunlight at high altitude, would light up with a spectacular brilliance.

After several weeks of its pole-over-pole globe circling, even the slight friction of the upper atmosphere would slow the MOUSE, letting it go down to make some investigations at lower altitudes before finally plunging earthward to consume itself like a meteor.

Dr. Singer does not recommend a space station as a military bombing platform, pointing out that one cannot just release a bomb from a space station since the bomb itself would become a satellite and not drop to earth. He feels, however, that his MOUSE would have some military value, such as gathering information for long-range weather forecasting and learning more about the vagaries of long-distance radio communication. And he adds another point. Using the upper atmosphere as a vast wind tunnel, the MOUSE could make aerodynamic measurements that would help in designing faster-flying and higher-flying jet and rocket aircraft—measurements that can't be made in any earth-bound wind tunnel, however big or powerful.

Would Foster U.S. Prestige

In another way, Dr. Singer feels that his modest MOUSE could become a mighty MOUSE: in the prestige it would give us with other peoples, and its psychological effect on any potential aggressor nation. It would boost our technical and scientific achievements sky high. It would shout, "If we can do this on a shoestring, think what we could do with guided missiles on a war budget." END

Tough Guy

Two trucks met on a country road just wide enough for one. Truck driver No. 1, a scrawny, frail little man, leaned out of his cab.

"Turn out, you!" he shouted. "If ya don't, I'll do to you what I did to the last guy who wouldn't turn out for me."

Two-hundred-pound, muscular driver No. 2, not caring to have trouble, pulled out. But as the other truck rumbled by, he yelled, "What'd ya do to that other guy?"

"Turned out for him," said No. 1.—*Wireco Life.*

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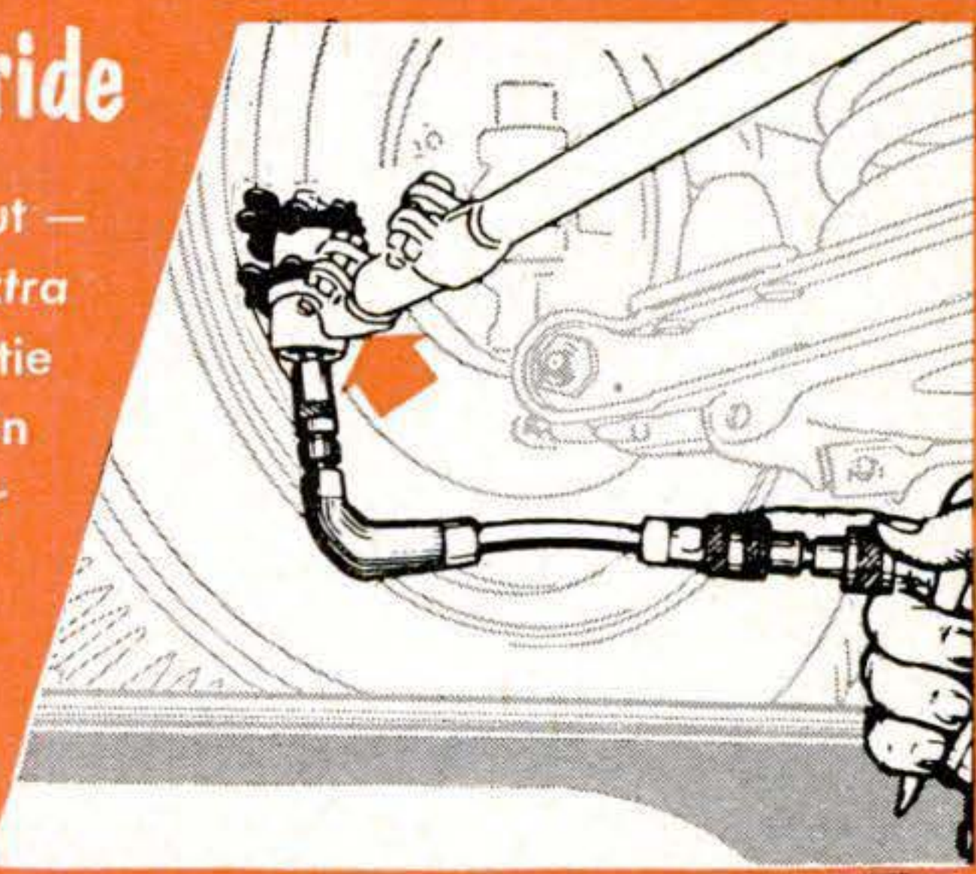
Texaco Tips on car care

How to get more miles from your tires

If your tires aren't inflated to the proper pressure, you won't get maximum mileage from them. To enjoy longer trouble-free life from your tires, see your Texaco Dealer for regular tire check-ups. He'll inspect the sidewalls for bruises and cuts. He'll check to make sure each tire is inflated to the correct pressure. If your tires show signs of uneven wear, your Texaco Dealer will detect it, make recommendations accordingly.

How to get that "cushiony" ride

Once *Marfak* lubricant goes on the job, it stays put — for one thousand miles or more. It's tough, *extra* stretchy (notice the sealing film of *Marfak* on the tie rod end). *Marfak* clings to chassis points of friction and wear . . . resists jar-out and squeeze-out far longer. For you, this all adds up to a smoother *cushiony* ride. And remember: your Texaco Dealer applies *Marfak* by chart — never by chance. Get *Marfak* lubrication today. See your Texaco Dealer . . . *the best friend your car has ever had.*



THAT "CUSHIONY" FEELING LASTS LONGER WITH MARFAK Lubrication

TEXACO T REG. T. M.

THE TEXAS COMPANY

TEXACO DEALERS

IN ALL 48 STATES

Texaco Products are also distributed in Canada and in Latin America

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[Continued from page 146]

"Sure, Lora," Gus said. "Matt, what say we adjourn this until we get back? If you'll get the bailing can, Guy, we can wet these embers down. The woods are wet and the fire's on sand, but there's no point in taking any chances." Grabbing two sticks by their unburnt ends, Gus tossed them into the water. In the dark he could now barely make out Bergstrom's face. "If you'll hold the light for me, Matt, I'd like to take a look at that kicker of yours."

Gus climbed into the boat, found the gas tank half full, and noted that the prop was clear of the bottom. He checked the air valve, set the choke and shoved over the spark. Handing the flash to Matt, he yanked the starter handle. The motor sprang instantly to life, idling throatily as he eased off the choke. It sounded fine, Gus thought, wondering if Matt would boil over again. He cut the engine, edged past Bergstrom and stepped ashore.

"Doesn't seem bad now," he said decisively, "but I think you ought to lead the way home, Matt. We'll be along as soon as that fire is wetted down."

Bergstrom was silent for a moment. "Get in the bow, Sally," he said abruptly. "But don't think you've heard the last of this—any of you."

Flickering Farewell

Matt's engine caught again quickly. The boat turned out into the darkness and picked up speed. As it rounded the point of the cove, Sally winked the flash twice in mute farewell.

"I hope they get along all right," said Guy doubtfully. "Or do I?"

After Guy shoved off they could still faintly hear the high-pitched beat of the other outboard in the dark. Then Gus fired up his own motor and they shot out of the sheltered cove. Around the point, waves slapped solidly against the hull and spray blew back over Gus until he eased off on the throttle.

"Look!" Guy saw it first—the yellowing beam of a flashlight out on the lake. They headed toward it. In a few moments the dim moonlight revealed the Bergstrom boat, broadside to the waves and rolling deeply. Matt was on his knees flailing at the starter; Sally flicked the tiring flash in merry greeting.

"Can't tow — painters aren't long enough," Gus called above his throttled-down motor. "Grab my gunwale, Matt, and hang on! I'll head back to the cove—too tough into the wind. Guy, take care of it at the bows. Don't get your hands pinched, either of you." He circled and came up alongside with bare steerageway, then fed more power cautiously once the boats were lashed together by two pairs of arms. They headed back precariously, the strain easing as they turned downwind.

Bergstrom Picks Up the Battle

With both boats beached once more, Matt lost no time in regaining the initiative. "I don't know what you did to that motor," he told Guy, "but you sure bollixed it."

"Gus Wilson, I asked you to take me home," snapped Mrs. Adams. "I don't see why you can't just leave him here—let him stew in his own childish juices. I suppose we could find room for Sally."

Gus felt an amused irritation. "Nobody's going to get marooned, Lora. I think five people are a bit too much of a load to take across in one haul tonight, but if necessary, I can make two trips."

"That mightn't be easy, Mr. Wilson," giggled Sally. "Remember the problem of the farmer who had to row a wolf and a lamb over a stream?"

"Before we do that, I'll take a crack at your father's motor," Gus said. "Worth spending a little time if it saves four trips across the lake. That flash is getting feeble—hold it in close, Guy."

Using the tool kit in the boat, Gus pulled and checked the plugs and examined the wires for raw places. He laid the reconnected plugs on the motor, spun the flywheel. Blue voltage snapped

[Continued on page 228]

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Things to do before you go:

BUY A NEW BATHING SUIT

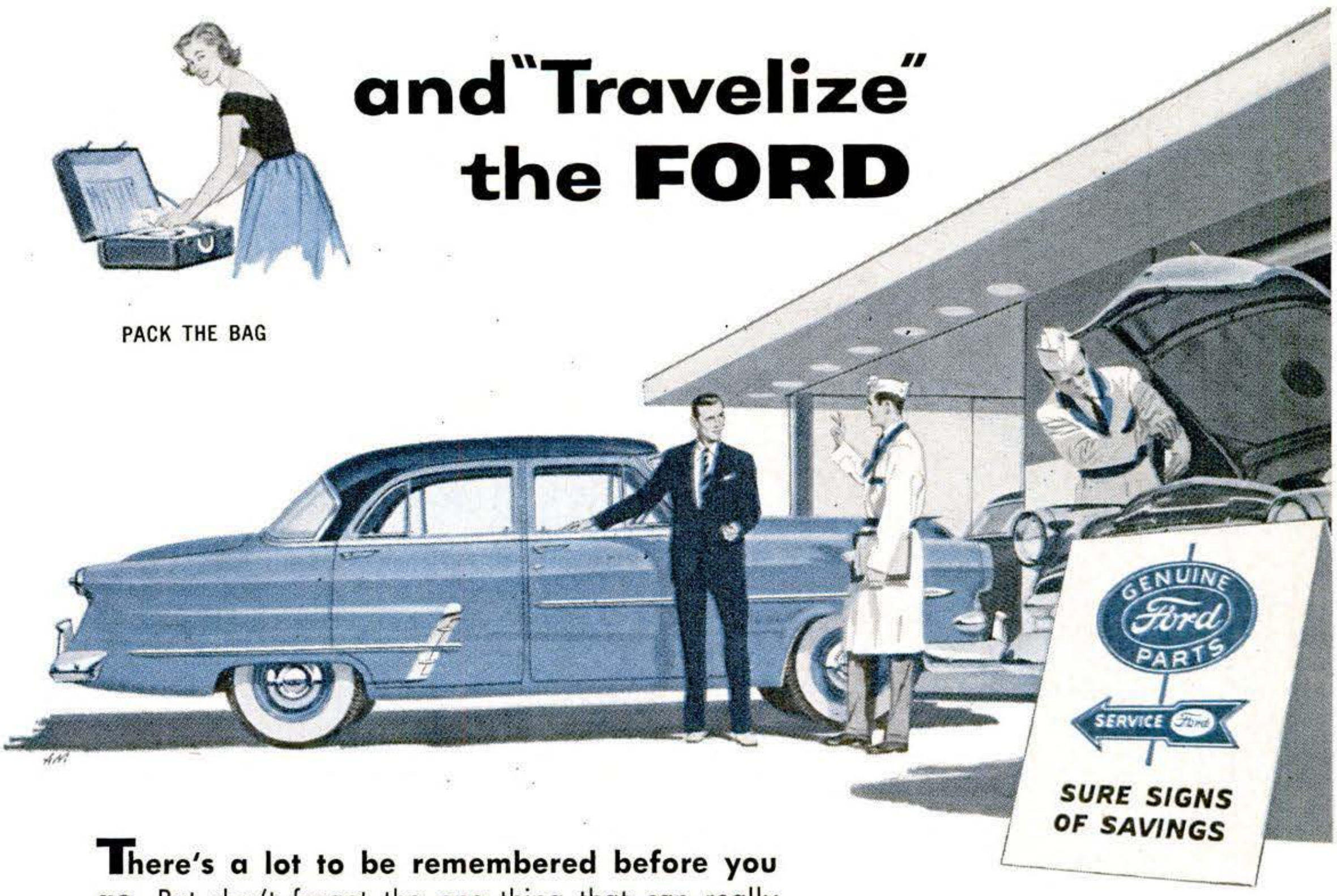
MOW THE LAWN

STOP THE PAPER AND MAIL

STOP THE MILK

PACK THE BAG

and "Travelize" the FORD



There's a lot to be remembered before you go. But don't forget the one thing that can really add most to the pleasure you have getting there: Have your Ford thoroughly checked and "Travelized" *now—before you go.*

And if replacement parts are called for, remember to insist on Genuine Ford Parts. They're *made right* to work right to last longer in your Ford.

Every Genuine Ford Part is designed to the same specifications set by the men who originally built your Ford, and thoroughly tested before approval for manufacture. They're your best assurance that your Ford will be fun to drive!

Wherever you go for service insist on Genuine Ford Parts

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Make painting easier around your home...

Pointers on painting outdoor furniture, doors, shutters, etc. If old paint is good, wash surface and sand lightly. Do hard-to-reach parts first (chair legs, door edges, etc.). Don't go back over after paint starts to set. Always . . .

Use brushes with bristles of Du Pont TYNEX* nylon

You pick up a full load of paint . . . flow it out in a smooth, even coat . . . when your brush has bristles of Du Pont "Tynex" nylon. This means faster, easier, better work on *any* painting job around your home.

And you'll find that "Tynex" bristles clean easily in any commercial cleaner . . . last up to five times longer than other types of bristles.

Send for free booklet on "How to Choose and Use a Paintbrush Bristled with Du Pont 'Tynex' Nylon." Write: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department PS-7, Wilmington, Delaware.

"Tynex" is Du Pont's new registered trade-mark for its genuine nylon bristles

Look for TYNEX nylon bristles when you buy brushes

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Take The "PAIN" Out of PAINTING

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SPRAY GUN

Take It Anywhere!
No Compressor . . .
No Electric Cords Needed.
Sprays: Paints, Oil, Varnishes Insecticides, etc.

Men! Women! Here's the easy way to lick those tough, tedious, tiresome paint jobs. Becker Spray Gun is fun to use, requires no electricity or compressors—pressurized by low-cost CO-2 cartridges each sprays up to 21 oz. containerful. Used 5 years successfully in industry.

SEE YOUR DEALER! If he cannot supply, order direct for pstpd. shpt. Extra cartridges 10 for $1.

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Scrape paint quickly

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Get your FREE copy of "HOW TO MAINTAIN WOOD FLOORS."

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MAKE $15,732.00 IN ONE SUMMER $9,504.00 WITHOUT LEAVING YOUR HOME

DON'T READ THIS!

Unless you are near a healthy fire extinguisher or a plentiful supply of WATER. We cannot assume responsibility if this ad breaks out in ROARING FLAMES. So please do stop reading this until you have taken the necessary safety precautions. Yes, we have an item that's H O T —so H O T that we are not going to say other than the usual words of a good product for fear of setting this good magazine on *FIRE*. This product is NEW! SENSATIONAL! COLOSSAL! AMAZING! and REVOLUTIONARY.—NO! No long story—All we have to say, and this is modestly, we have an ELECTRICALLY controlled bulb that is the BEST insect killer CONSOLIDATED RESEARCH has been able to produce—bar none. Not to be compared with any other unit ever sold.

Testimonials like these are pouring in by the hundreds.

"It works like a charm. I am amazed at its results."—Mrs. A. F Wills, Atlantic City, N. J.

"Your magic bulb has at last solved my roach and fly problem."—Mrs. C. I. Thompson, Miami, Fla.

"Has given my family endless hours of comfort living."—Mr. P. V. Zane, Los Angeles.

You have heard of the 7 Wonders of the World. Now, consolidated research introduces the 8th Wonder, acclaimed a MUST in every home and establishment. Being hailed by salesmen as the biggest MONEY MAKER since the opening of the U.S. MINT.

ABSOLUTELY EVERYONE

Now that you have taken the safety precautions, read every word in this ad, as we have said above, this item is **HOT,** so hot that to be extra safe we have ordered the publishers not to use any **RED** ink. Now, getting serious, fellows, here's the scoop. We are going to do **EVERYTHING** to make you the most welcomed salesman to ever approach a customer. We will give you **GLOSSIES, MATS, IMPRINTS,** all the material needed for an immediate mail order set up, also documented test reports of how prominent colleges and testing labs, **RATE** our product, also at your disposal is a powerful pulling pitchman sound T.V. movie on Bug Weapon. The production value of this film cost us more than $2000.00, **PLUS BELIEVE IT OR NOT** an advertising allowance. We will **PRE-SELL** this Bug Weapon for you, by launching a tremendous advertising barrage, including almost all national magazines, radio, and T.V. The entire population of the U.S. will be put in a buying mood. Especially so since hundreds of insects will help you make every sale. They will dive bomb about him, molest his comfort, interrupt his sleep, destroy his property, and spread contagious diseases about his home, and food. Business establishments suffer enormously combating the ugly insect problem. They will greet you with arms wide open. It's a tested natural with **STAGGERING** public acceptance and mountainous profits. Yes, you will be **WELCOMED,** you will be **THANKED,** most important you will make **MONEY.**

VOLUME SALES CORP., Research Dept. PS-8
2000 Market Street Philadelphia 3, Pa,

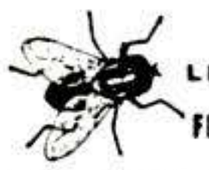
MOSQUITOES SILVER FISH MOTHS TERMITES

New! 20th CENTURY BUG WEAPON

FREE READ HOW!

DEATH

TO DISEASE-CARRYING, DESTRUCTIVE AND ANNOYING PESTS



LICE FLIES

SPIDERS ROACHES

GNATS ANTS

AMAZING NEW INVENTION

KILLS ALL TYPES OF INSECTS

SCIENTIFICALLY·AUTOMATICALLY

10-YEAR GUARANTEE

Not a gadget — not a halfway measure. Not to be compared with flimsy, untried imitations. A finished quality appliance. Carries an ironclad 10-year guarantee and parts replacement policy. Bound by signature.

COST ONLY PENNIES A MONTH TO OPERATE

DID YOU KNOW?

that flies and roaches are suspected carriers of 13 communicable diseases including **POLIO.** One fly can reproduce 8 million others. Flies seldom leave anything without first excreting on it. Don't take chances with your health. **YES,** you can now insect proof your home without lifting a finger. Throw out old fashioned fly swatters, and messy spray guns. A new, small, clean, decorative, little bulb enables you to destroy **HUNDREDS** of types of **INSECTS** like **MAGIC.** Only one 2 hour application keeps killing disease carrying, destructive and annoying insects around the clock for more than 2 weeks. More powerful than D.D.T. yet harmless to humans, pets and plants. Approved **SAFE.** Not a gadget, not a half way measure Carries a **10 YEAR GUARANTEE.** It must **KILL** not **TICKLE** roaches, flies, moths, ants, and hundreds of others or your money **REFUNDED.** For your health's sake order **SEVERAL** units **NOW.** Everyone send us a check, M.O. or cash for $2.98—C.O.D.'s accepted. Should you, after testing your unit, decide that you would like to join us in the sales of this new public servant, we will refund your $2.98 making your unit **ABSOLUTELY FREE.**

ODORLESS • SILENT • MYSTERIOUS

FREE DEMONSTRATOR COUPON

☐ Enclosed is $2.98. Send me one unit for my personal use.

☐ Enclosed is $2.98 in cash, check or M.O. Rush me one 20th CENTURY BUG WEAPON with sales aids, and LOWER wholesale prices. However, should I become an active salesman, you of the Volume Sales Outlet are to REFUND my $2.98 making my demonstrator FREE. Furthermore, I must agree that everything you say be true or I will return everything for a refund.

☐ Send one MONEY MAKING sales kit C.O.D.

☐ Lost time is lost money. Rush me .....dozen BUG WEAPONS, at your wholesale price. Don't forget to include my FREE demonstrator and sales aids, C.O.D.

☐ Together with the enclosed order don't forget to show me how to make $4.37 on each $2.98. $15,732.00 in one summer. $9,504.00 without leaving my home.

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ADDRESS.....

CITY.....STATE.....

(Members of the Mail Order Business Bureau)

VOLUME SALES CORP., Research Dept. PS-8
2000 Market Street Philadelphia 3, Pa.

ABSOLUTELY EVERYONE MAIL THIS COUPON NOW!

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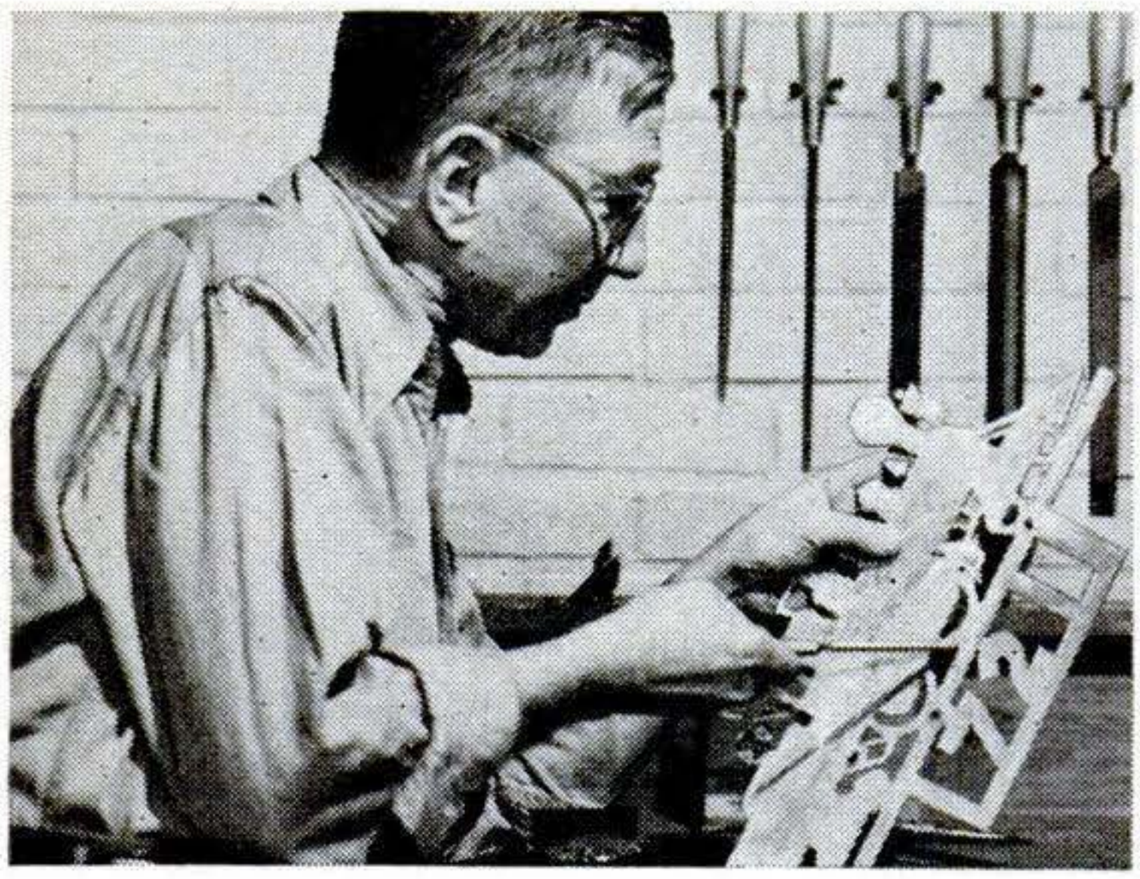
DO-IT-YOURSELF PROJECT WITH TRIPLE PAY-OFF

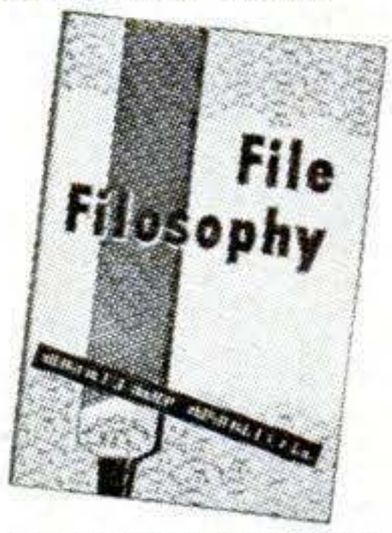


In making his own house sign (for example), this man is (1) saving money, (2) adding to the value of his home, and (3) having a lot of fun doing it.

What's more, his pride of achievement is heightened by his possession and use of *good* files. They're NICHOLSON. This and BLACK DIAMOND are the most famous two brands in the world.

He knows their teeth are sharp, evenly high, of uniform hardness, and have extra-long life. They're the choice of both the professional and the exacting amateur craftsman. They've the quality good hardware and tool-supply dealers like to recommend.

FREE—*"File Filosophy,"* Nicholson's famous 48-page illustrated book on kinds, use and care of files. Shows and describes many types of files for use on all sorts of projects comprising hard or soft metals, wood, plastics, etc. ***Send for it.***



NICHOLSON FILE COMPANY
19 Acorn Street, Providence 1, R. I.
(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

NICHOLSON U.S.A.

BLACK DIAMOND TRADE MARK

NICHOLSON FILES *FOR EVERY PURPOSE*

Gus Rides Out a Storm

[Continued from page 224]

across the points. He turned to the carburetor, squinting in the dim light.

"Sure wish we hadn't doused that fire," he said. "This is mean to see."

"I can get another one going right there on the beach," Guy volunteered. "Anyone got any matches?"

Gus felt his pockets, shook his head. "I don't smoke," rasped Matt.

Clever Fireman

"It doesn't matter—show them what you did before," Sally called from the shore. "Toss me that old flash and I'll get some branches from the dead pine."

The two youngsters pitched in, glad of the chance to show off before their elders. In a moment Sally dumped an armload of pine boughs just above the water's edge, handed the almost worthless light back to Guy, and went back for more. Guy uncoupled the fuel line, drew a cupful of gas into the bailing can and handed it over to Sally, who poured it on the wood. Guy tore a narrow strip from his handkerchief and wet it lightly with gas. He folded it into a pad, checked that the tank was capped and the fuel valve was off.

"All set?"

"You bet."

Using pliers to hold the pad by the end of one plug, Guy hauled on the starter handle. Nothing happened. The second time he tried, snapping sparks ignited the cotton. Carefully holding the flaming little torch with the pliers, Guy stepped ashore and tossed it on the fuel-soaked pine. At once the fire flared.

Treasure Trove—Two Hot Dogs

"Hey, that's pretty slick," Matt said. The warm, dancing light seemed to cheer everyone up. Lora Adams, investigating the picnic hamper, held up two hot dogs she'd found.

"With a frying pan, we could cook up a little snack," said Mrs. Adams.

"I'll get you a couple of green sticks," Matt told her suddenly. "Wait a second."

[Continued on page 230]

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START YOUR OWN BUSINESS (FULL or SPARE TIME)

with ROTO-HOE GARDEN TOOLS

In many communities we need active mechanically-inclined men as dealers to sell and service ROTO-HOE and attachments. It's pleasant, outdoor work and you will find it's easy too. These popularly priced power garden tools have won the hearts of tens of thousands of American home owners and gardeners—in fact, ROTO-HOE is now the largest selling tool of its kind in the world!

If you are not afraid to get out, make calls, and demonstrate ROTO-HOE, and do the small amount of servicing required, you should be able to develop your own highly profitable spare time (or full time) business—on a minimum investment. We furnish you names of prospects in your neighborhood also circulars, catalogs, and other sales material.

Write today for full information—it may be the opportunity you wanted for years!

ROTO-HOE & SPRAYER CO., Box 18, Newbury, Ohio

MAGNETS 225 lb. PULL

GENUINE ALNICO - NEVER WEAKENS

AMAZING, PERMANENT MAGNETS—WILL NOT WEAKEN! NON-ELECTRIC

Retrieve guns, tackle, tools and other steel items from lake, river, plating tanks, drains or other hard-to-reach spots. Recover drills, taps, etc. from sweepings. Clear alley of harmful tacks, nails. Many other uses. Pays for itself quickly. GUARANTEED. Try any magnet one week. Money refunded if you are not well pleased.

No. S-725 (Weighs 54 oz.) Has pull of 225 lbs. on steel block **$15.00**
No. S-675 (Weighs 49 oz.) Has pull of 175 lbs. on steel block **$10.50**
No. S-650 (Weighs 41 oz.) Has pull of 150 lbs. on steel block **$ 8.50**
No. S-500 (Weighs 15 oz.) Has pull of 50 lbs. on steel block **$ 4.00**
No. S- 30 Hobbyist assortment of six small magnets.....**$ 1.50**

Send Money Order or check. We pay postage. No C.O.D.'s.

MIAMI MAGNET COMPANY, 3240 N.W. 27th Ave., Miami 42, Fla.

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3 CU. FT. MIXER DIRECT FROM MFR. 39.75

Fills long felt need for small mixer for concrete, feed, fertilizer, seed and many other materials. Saves 3/4 cost of ready mixed concrete. Pays for itself on first job. Combination belt pulley and crank for hand operation. Also power mixers. Write for circular.

3 Cu. Ft. Drum—Mixes 2 Cu. Ft. Concrete $39.75
5 Cu. Ft. Drum—Mixes 3 Cu. Ft. Concrete 59.50

FOB Pulaski, N. Y. Cash, Check or M. O. Money back guarantee.

UNITED STATES FORGE AND FOUNDRY CO.
CONSTRUCTION EQUIPMENT DIV. PULASKI, NEW YORK

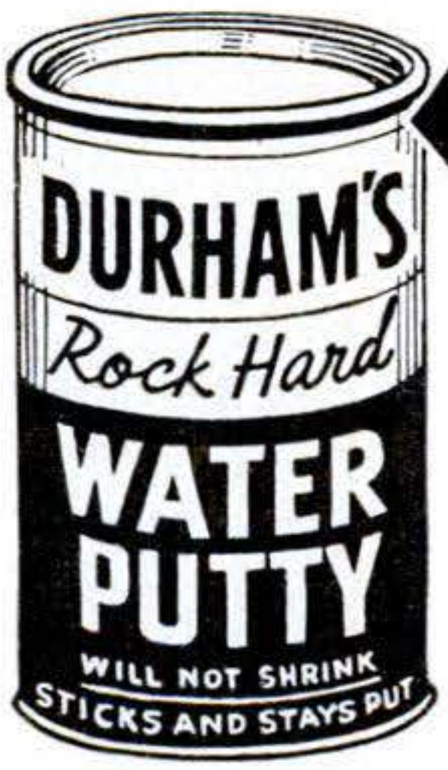
SHOPMASTER'S

NEWEST SENSATION

COMBINATION POWER TOOL

For Complete Information Write Dept. 11N
1214 S. 3rd St., Minneapolis, Minn.

SHOPMASTER, INC.



The Modern PLASTIC for lasting Home Repairs

PERMANENTLY mends cracks or holes in wood, tile, stone or plaster. Sticks and stays put—Does not chip, shrink or fall out. Easy to use. Economical. Mold it, chisel it, polish or paint it. If unobtainable from your lumber, paint or hardware dealer, the big 4-lb. can will be sent you postpaid (in U.S.) for only $1.25. Full money-back guarantee, order now.

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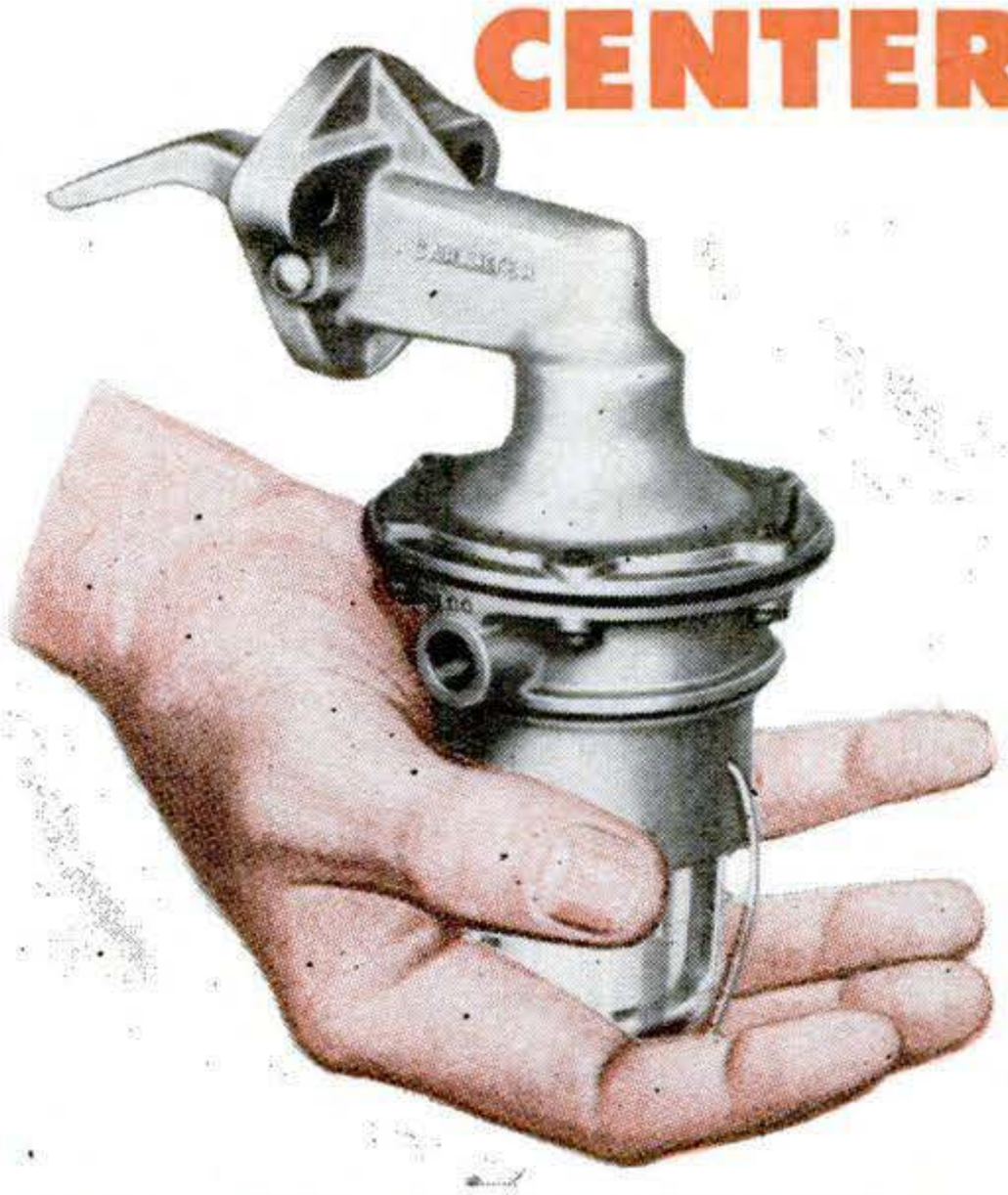

CARTER POWER CENTER® FUEL PUMP

Your Car's Best Protection Against Fuel Pump Failure

Here's a fuel pump that'll never let you down—the most dependable ever developed. Its extra capacity and durability combine to assure years of steady, smooth-pumping action under the roughest, toughest driving conditions.

See your nearby Carter dealer. He's listed under CARBURETER in the yellow pages of your phone book.

CARTER CARBURETOR CORPORATION
St. Louis 7, Missouri
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Shavings from the WIZARD'S WORKSHOP

by the Weldwood Wizards with Wood

WHAT'S YOUR "SHAVING?" *Want your short cut or shop trick printed? Send it to United States Plywood Corp., Box ....., N.Y. 36, N.Y. If used, we'll send you a one year subscription to this magazine. All entries become our property. None can be returned.*

NOTHING CRUMBY ABOUT THIS. Take the wife's breadboard and cut a shallow rabbet all the way around. Now glue and screw a frame to the edge of the board, flush with the cutting surface. Crumbs from cutting just fall into the rabbet.

LIKE A HAPPY MARRIAGE. If you want wood joints to last, use Weldwood Plastic Resin Glue. It makes a bond stronger than the wood itself. And it gets stronger as it ages. Always in perfect condition when you want to use it, because you mix it yourself from the powder, in a few seconds. Stain-free, rot-proof, highly water resistant, inexpensive. America's largest selling wood glue.

HELP BY THE BOOKFUL. Ask The Government Printing Office, Washington 25, D.C., to send you FREE, "Hobby Publications"—a list of booklets from which you can select many useful volumes.

"LOOKS LIKE A MILLION." Here's a sure easy way to get that costly hand-rubbed "natural" finish on wood tables, book shelves, cabinets, etc. Use easy-to-apply Satinlac. Works on any wood, hard, soft, solid, or ply. Satinlac doesn't look "built-up"; doesn't darken the wood or turn yellow. Gives "pro" results and protects the wood.

NO HITS — NO ERRORS. Here's how you can banish accidental hammer dents in wood surfaces. Cut a hole through a piece of heavy cardboard. Slip it down over the nail — it will take the dent if your hammer misses.

A PRETTY PICKLE YOU'LL LIKE. Those luxurious pickled or blond wood finishes you see in the fashionable furniture stores are easily yours. Use White Firzite for blonding or pickling. For pastel tones, tint White Firzite with colors-in-oil. You'll get exciting professional results on any wood!

TRICK OF THE PAINTER'S TRADE. On soft wood or fir plywood stain jobs, you can tame that "wild" grain with a coat of Clear Firzite. Gives that smooth expensive-wood finish.

*TRADEMARK

WELDWOOD®
Plastic Resin Glue
Makes a bond stronger than wood itself. Highly water resistant.

FIRZITE®
White for pickled or blond effects. *Clear* tames wild grain on stain jobs.

SATINLAC®
For exquisite natural wood finish. Enhances natural grain; preserves the surface.

At hardware, paint, lumber dealers.

United States Plywood Corporation
Dept. 136, 55 West 44 St., New York 36, N. Y.
Send me free leaflets on Weldwood Plastic Resin Glue, Firzite and Satinlac.

NAME_____

ADDRESS_____

Gus Rides Out a Storm

[*Continued from page 228*]

He trotted up to the edge of the woods.

Gus smiled as he worked over the carburetor. The float needle moved freely and there was no grit or sediment inside. He uncoupled both ends of the gas line and drew out a two-inch bronze filter element. The line was clear. Taking up the metal filter element, he shook it, blew through it until his cheeks bulged, and stared at it for a moment.

Then he did a strange thing. Laying the filter element on the seat, he drove the point of his knife right through it. He blew through it again, and then carefully reassembled the parts.

"Now," he said with conviction, "we can go home."

"Darndest thing I ever saw, Gus," said Matt, "the way you drove a knife right through that thing like butter."

Motor Starved by Clogged Filter

"It's not hard. The filter is a kind of spongy bronze—it works fine, stops dirt or water dead in its tracks. Like any filter, it clogs up if it has too much work to do. When it's almost saturated with water it will starve a motor, but let enough gas through for idling. Let the motor sit a while, and enough gas will dribble through into the carburetor to run at full throttle for a few minutes.

"In the shop you can blow out the trapped water with compressed air, but I put a slit through just in case. May be a little water-spitting from the motor, but I doubt it."

"If you great brains have that problem licked," said Mrs. Adams with amiable tartness, "maybe you'll tell me how to divide up two roasted hot dogs among five people."

"Three people," corrected Guy, who was sitting by the fire with his girl. "Sal and I can't eat and harmonize at the same time." They sang a chorus of "Show Me the Way to Go Home" and it seemed to Gus, whose ear was better tuned to knocking than to flatting, that it was darned nice music. END

NEXT MONTH: Gus closes a sticky case.

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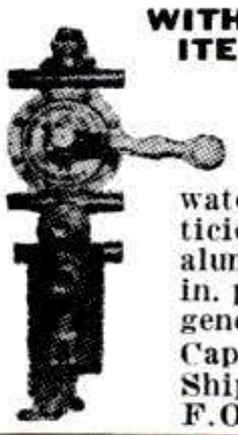
Brand New! WAR SURPLUS Released Since KOREAN TRUCE

PESCO GEAR TYPE
HYDRAULIC PUMP
Compact — Powerful — Reliable

ITEM #160—Especially designed for belt drive from fan belt, power take-off, drive pulley, electric motor or small gas engine. Equally suitable for direct coupling. Pedestal type mounting with two bolt holes for 3/8" hold-down bolts. Standard 1/2" pipe thread inlet and outlet ports. Delivers 4.5 GPM at 1000 PSI at 2800 RPM with 3 HP. Will actuate one item #224, 3 1/4" bore, 24" stroke cylinder in 10 seconds. Hardened steel gears turn in dense oilite bronze bearings. Rotation—clockwise facing shaft. Guaranteed trouble-free service. Ship. wt. 6 lbs. F.O.B. Chicago **22.50**

SELF-PRIMING
HAND FLUID PUMP
WITH STRAINER



ITEM #129—Type D-2—May be used as a boat bailing pump, sump pump, barrel pump, fuel transfer pump, for water, oil, gasoline, insecticides, etc. Bronze and aluminum construction, 3/4 in. pipe thread ports. Fine general utility hand pump. Capacity—300 Gal. per hr. Ship wt. 6 lbs. F.O.B. Chicago **11.95**

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SATISFACTION GUARANTEED
Send Payment Or Purchase Order Today

BRONZE & MONEL BALL BEARING
GEAR PUMPS

ITEM #204 For— • Insecticide Pumping and Spraying of D.D.T., 2-4D, Chlorodane, etc. • Self-Priming—use as Shallow Well Pump • For Sprinklers • Home Water Systems • For Sump Pump • For P.T.O., Direct or Pulley Drive • Rated—6 G.P.M. at 600 R.P.M.—18 G.P.M. at 1800 R.P.M., 36 G.P.M. at 3600 R.P.M. • Pressures to 250 P.S.I. • Use 1/4 to 5 H.P. • 1" Pipe thread inlet, 1" hose outlet • Shipping Wt.—15 lbs. F.O.B. Chicago..... **24.50**

S. L. S. ON THIS
Brand New—Pesco
ITEM #371V
HYDRAULIC CONTROL VALVE

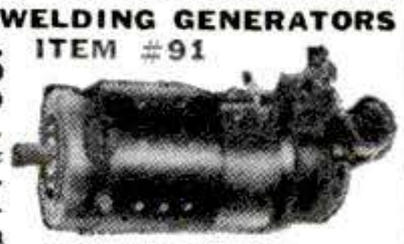
FOR SAFE POSITIVE CONTROL OF HYDRAULIC CYLINDERS AND MOTORS — • BUILT-IN RELIEF VALVE—factory set at 1200 P.S.I. • FOUR WAY VALVE—to operate one double acting cylinder • OPEN CENTER—with valve in neutral, cylinder is locked in position and pump is unloaded. • SPRING RETURN TO NEUTRAL • FULLY BALANCED PLUNGER • EASILY STACKED INTO 2, 3, or 4 valve combinations for multiple cylinder operation. • 8 gal. per min. capacity, at 1500 P.S.I.—3/8" pipe ports. • CONNECT PUSH RODS TO HANDLE FOR REMOTE CONTROL. • EASY MOUNTING • LIST PRICE—$46.80. • YOU SAVE $30.30. • DIMENSIONS—9"x4 1/2"x2 1/2"—Ship. Wt.—8 lbs..... **16.50** F.O.B. Chicago

GROBAN HYDRAULIC SPEED REDUCER
with FINGERTIP CONTROL

USE FOR. • **Reamer Drives** • **Midget Cars** • **Feed Mills** • **Canning Machines** • **Conveyors** • **Lathes** • **Milling Machines** • **Motor Boats** • **Cream Separators** • **Garden Tractors** • **Pumps.** Variable output speeds from 0 to input speed available by moving control handle. Locking handle maintains setting. Use input power of 1/4 to 1 1/2 H.P. Shafts 5/8" diam. Input rotation counter-clockwise facing shaft. Input speed 750 R.P.M. 7 1/2"x7 1/2"x 11 1/2". Gov't acquisition cost $428.00. Shpg. wt. 31 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago..... **54.50**

ITEM #115

300 AMP. D. C. GENERATOR
IDEAL FOR WELDING GENERATORS



Type R-1, **ITEM #91** rated 300 Amps. — 30 Volts. Mfd. by Jack & Heintz. Government Acquisition Cost $380.00. Shpg. wt. 55 lbs. Dimensions: 16" x 10" x 7". Complete with instructions to connect as Welder. F.O.B. Chicago..... **35.00**

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HYDRAULIC CYLINDER

ITEM #31C—3 1/2" bore, 11" stroke. Alloy steel cylinder wall. Micro-Honed and all steel 1 1/8" diameter piston rod. 19 1/2" overall length closed. Clevis mounting at base and shaft. Will lift 9625 lbs. with 1000 PSI Pump Pressure. Uses 3/8" tubing fittings. (Fittings to pipe thread: two 3/8" MPT @ 35c.) A $102.00

value. Shipping weight 11 lbs. FOB Chicago..... **25.00**

BLACKHAWK
HAND-HYDRAULIC PUMP

ITEM #82. Perfect for Hydraulic Presses, Snow Plows, Farm Wagons, Jacks and Farm Plows.
A few easy strokes of the 20" handle and you can lift 5000 lbs., ing a 2 1/2" bore — Hydraulic Cylinder. Blackhawk Model P-151—complete with built-in oil tank and release valve.
Rated 1200-8400 lbs. per square inch. Dim.: 9"x7"x6". Ship. wt. 35 lbs. Worth much more. F.O.B. Chicago..... **22.50**

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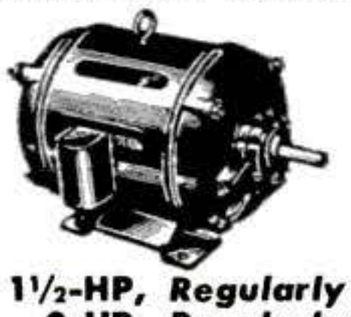
(Immediate delivery. Order cash or C.O.D., or send for folder)
VYKE MFG. CO., S-2439 15 St., Denver 2, Colo.

LIMITED SUPPLY! BRAND NEW, BALL-BEARING
1 1/2-HP, 2-HP, 3-HP ELECTRIC MOTORS
FAMOUS BRAND! SAVE WAY OVER HALF!



Powerful Capacitator motors with heavy starting torque to handle EVERY heavy-duty job. New, ball-bearing models that mount IN ANY POSITION. 3450 RPM, 115-230 volts, 60 cy., single phase. *Perfect for* saws, wood-working tools, blowers, grain elevators, pumps, and farm equipment. Fully Guaranteed. Save dollars.
ORDER DIRECT FROM THIS AD TODAY!

1 1/2-HP, *Regularly* $110.00. Special sale.....$47.50 fob
2-HP, *Regularly* $130.00. Special sale.....$57.50 fob
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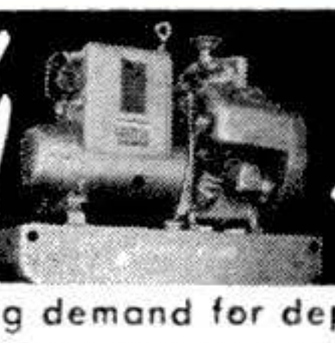

NEW air cooled gas engine driven arc welder

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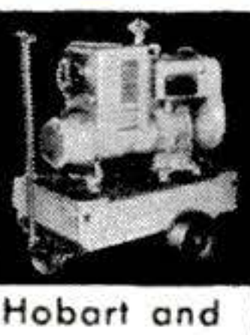
Husky Boy for indoor, outdoor welding



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Cash in on the big demand for dependable arc weldors. Set up your own shop —full or part time—with a Hobart and start earning hundreds of extra dollars.

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OVER 3,000 in use in schools, universities, by hobbyists. **15X** eyepiece included in purchase price. **4X, 8X, 10X, 12X** eyepieces available. See catalog. Excellent optics throughout. Plano, concave mirror. 6-aperture diaphragm, condenser. Triple revolving turret. All metal, heavy and substantial.
Mechanical stage is **$14.95** extra. Shipped in fitted hardwood cabinet, insured
Made by quality Japanese optical mfrs. to our rigid designs and specs.
10-DAY MONEY-BACK GUARANTEE. One third deposit on C.O.D.
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Rustless aluminum construction. Weighs only 4⅞ lbs. 7" hardened steel blade. Die-cast motor housing keeps out moisture, dirt and grass. Fully insulated handle encloses wiring, prevents tangling in shrubs and plants.

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Blade Stops Automatically upon striking rocks, hummocks or other obstructions. Prevents motor and switch burnouts.

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A Practical Reliable Tool for long, heavy-duty service.

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Please send me complete details and name of nearest dealer for your "Yardmaster" Grass Trimmer No. 134.

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In Canada write Strongridge, Ltd., 124 Weston St., London, Ont.

The Truth About Your Brakes

[*Continued from page 104*]

Suppose a car is put to a standard fade test. Accelerate it to 75 and brake it down to zero at a standardized high deceleration—just shy of sliding rubber. Repeat the cycle immediately, for up to a hundred times. As the brakes grow hotter, the required pedal pressure climbs up. If the car is a bad fader, you'll reach a point where you can't get the standardized high deceleration no matter how hard you push. More likely you'll reach a kind of stability. Needful pedal pressure may climb up 30 or 35 percent, then level off and hold.

What happens, of course, is that the brakes have become as heat-soaked as they will get. It follows that everything designers can do to lower this stabilized temperature helps control fade. Most past work has been on metallurgy and heat transfer inside the brakes. In the future there'll probably be more attention to air flow outside, including ducting, fanlike disk wheels, and more fins.

Decelostats yet. On a crash stop with all four wheels sliding, you have almost no directional control. A rolling wheel wants to go where it's pointed; a sliding one doesn't give a hoot where it goes. One possible answer to high-deceleration swerves is the "decelostat" or brake governor. This is a rotation-sensitive dingus that instantly and slightly eases braking on a sliding wheel.

Similar devices work well on trains, to prevent "flat" wheels, and on aircraft, where a blowout caused by a locked wheel on the landing run-out can be bad business. Preliminary proving-ground work suggests that governors may help a bit on fast-stop swerves. Detroit people are close-mouthed here. END

Riding in Style

The teacher had been giving the class a description of different kinds of railroad cars and she paused to ask if anyone knew what cars that carried cattle were called. A moment of silence, and Johnny called out, "I know, they are Cattleacs."—*L & N Magazine.*

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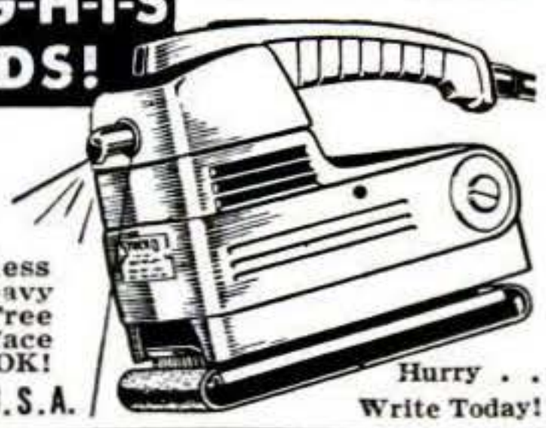
NEW SANDER L-I-G-H-T-S WORK AS IT SANDS!



Only SYNCRO '900' SANDER gives you all this: built-in work light—most powerful reciprocating sander motor (patented) and guaranteed against burn-out during ownership—removes more material with less upkeep—no twisty torque to fight—heavy duty. Write for amazing low cost. Free Syncro Catalog and new FREE "Surface Preparation" SANDING HANDBOOK!

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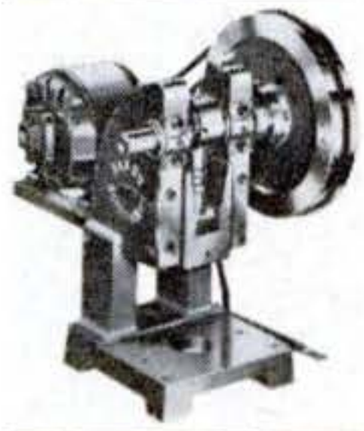

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Does work of Jig, Keyhole, Coping, Band, Rip, Hacksaw. Has built-in **air blower**, fits any 1/4" drill, cuts wood, pastics, metals. At your dealer or try it on our **10-day trial**. Send check, M.O. (Postpaid). C.O.D.'s—postage extra.

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QUICK-WAY Saw Company
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Only AMERICAN has it!

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BIG PAY SANDING FLOORS

Get ahead in fast-growing building field! Be a floor surfacing contractor and sand both new and old floors. No experience needed. High earnings, steady work with a future! Write for booklet "Opportunities in Floor Surfacing," enclosing 25 cents in coin or stamps to cover handling.

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The American Floor Surfacing Machine Co.
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☐ Send full details on new easy way to Dry Clean Rugs and make money!

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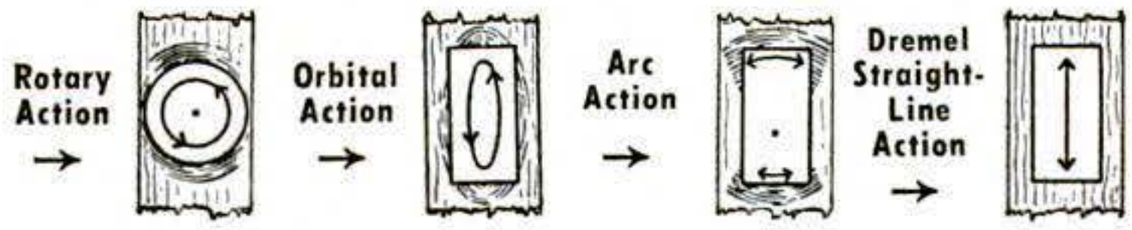
Do it with DREMEL Straight-Line Action Sanders

Get perfect finishes...no gouges ...no scratches...no swirls!

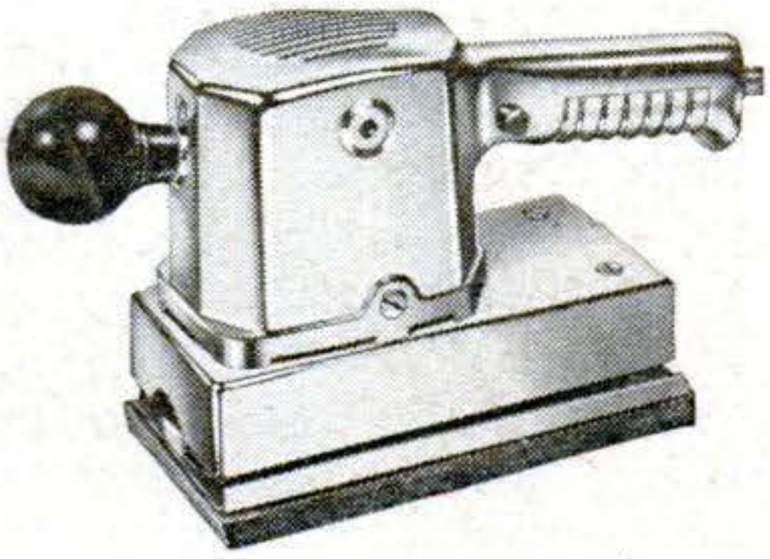
For the finest finish sanding, take a tip from the professional craftsmen—insist on Dremel *Straight-Line Action* Sanders. They save you money when you buy them. They save time, labor, and expense when you use them. And they're guaranteed to produce finer finishes because straight-line action sands with-the-grain—prevents cross-grain scratches and orbital swirls. Hobbyist, jack-of-all-work, or professional—there's a Dremel Sander for your needs.

Of the four common sanding actions, only Dremel sands 100% *with-the-grain* — the only guaranteed scratch-free action approved by finishing experts.



NEW MODEL "53" SANDER WITH POWERFUL BALL-BEARING ROTARY MOTOR

This new sander is a real powerhouse, a professional tool at a handyman's price. The first ROTARY MOTOR (AC) sander of its kind to have straight line action. Weighs only 5¼ lbs., has 24 sq. in. sanding pad. Out - performs other makes selling for twice as much. Positively the best heavy - duty sander buy on the market. Complete with 2 detachable sanding pads.... **$34.85**



EXCLUSIVE! Model "53" has a quick-action detachable sanding pad. Extra pad furnished free.

Model "2000" Sander-Polisher

Perfect for small shop, home use. Features Dremel "Straight - Line Action"; high speed reciprocating motor; 14,400 strokes per min.; wt. 5 lb.; 21 sq. in. sanding surface.

Price includes: Sturdy, steel carrying case, Model "2000" Sander-Polisher, 1 polish pad, 25 asst'd abrasives..... **$24.50**

Model "A" Sander-Polisher-Massager

Three tools in one! Lighter capacity for general-purpose use. Features "Straight-Line Action"; high speed reciprocating motor; Wt. 2½ lbs.; 12 sq. in sanding surface. Complete with 1 polish pad, 1 massage pad, 6 abrasives..... **$14.85**

SEE YOUR DEALER: If he cannot supply, order direct on 5-day trial, money-back guarantee. Remit in full for postpd. shipment; or send $2, pay postman balance plus postage and COD.

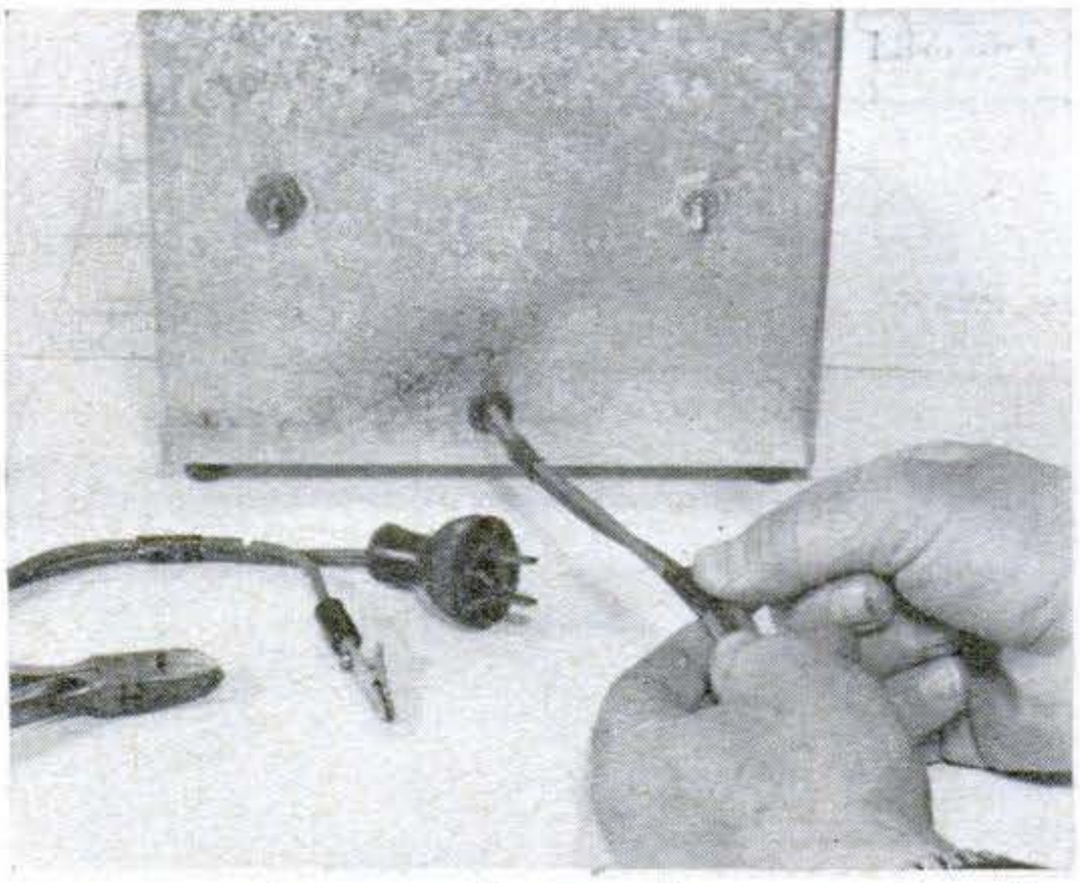
DREML MFG. CO., Dept. 124-H, Racine, Wis.

[Continued from page

small capacitors, but they all be of the same voltage rating. C ie altering C1 until the healthiest cor obtained.

The plate of the tube may glow dull red. This is normal and no cause for alarm. But if prolonged operation brings the plate up to an orange or yellow glow, the plate switch should immediately be turned off and the tube allowed to cool, with the filament left on. If the tube tends to overheat constantly, change the grid resistor to one of 5,000 ohms.

Keep off the air waves. Since the Tesla



THE FRONT PANEL, shown above, carries the two toggle switches and a grommet through which the line cord and the ground wire pass. Tape the ground safety wire to the line cord every few inches and attach an alligator clip to the end of it. When plugging in the outfit, fasten the clip to the screw holding the cover plate of your household power outlet, backing the screw out a bit if necessary. This grounds all of the exposed parts for safety.

coil shown is sharply tuned to a frequency off the broadcast band, it should cause less interference on radio and television than an arc welder, electric shaver or other sparking device.

However, harmonics or stray frequencies may cause a buzz at certain points on the dial of a radio placed only a few feet away. Moving the radio or the coil a short distance may clear this up.

Connect only small objects to the high-voltage terminals. Avoid large plates or long wires, as these radiate excessively, and may cause radio interference, besides stealing power from the corona effects. Be sure you always ground the power clip before switching on the unit. END

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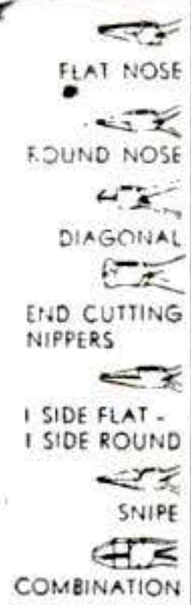
ILLUSTRATED CATALOG HUNDREDS OF TOOL & TOOL KITS 25¢ REFUNDED ON FIRST ORDER

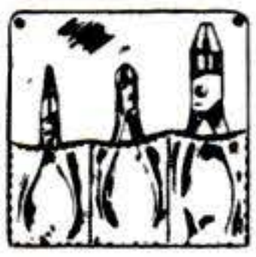
ONLY 75c EACH FOR FINEST IMPORTED PRECISION PLIERS



For Jewelers, Optical Workers, Hobbyists, Craftsmen of all kinds. These superb German instruments are of drop-forged, heat-treated high quality tool steel, fabricated, ground and polished to most exacting specifications. Smooth working joints. Jaws meet perfectly to hold the most delicate objects. Each plier is 4" long and a gem of precision and strength. 7 types to choose from: Flat Nose, Round Nose, Snipe, Combination, Diagonal, End Cutting Nippers, or 1 Side Flat and 1 Side Round.

75c each

3 Pc. PLIER SET



Finest drop forged imported steel. Ground and polished heads, polished finish, and knurled handles for easier grip. Individually pocketed in heat sealed plastic kit.
1—Linesman Slip Joint, 7"
1—Long Nose, 5¾"
1—Diagonal, 5¾"
complete set postpaid **$2.98**

6 FOOT WOOD FOLDING RULES

Made of well seasoned lumber with metal tipped ends and spring joints. Markings are sharp and clear, graduated in 16ths. 6 foot lengths.

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ALUMINUM LINE & POCKET LEVEL

Made of hard aluminum tubing, ⅜"x3", hexagonal shape, with 2 sturdy hooks for hanging on line. Equipped with luminous vial, tested for accuracy.

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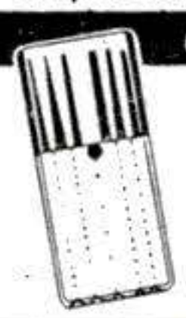
High lustre chrome plated instruments of outstanding quality and accuracy. Set includes Plain and Ringhead Bow Dividers, Compasses for use with ink or pencil, Ruling Pens and all necessary parts. Packed in a velvet lined, snap button closure, simulated leather case.

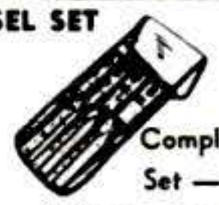
Complete Set — **$3.29** postpaid

6 Pc. METAL CUTTING FILE SET



Made from the best quality tool steel, designed for the requirements of mechanics, instrument watch and jewelry craftsmen. Compartmented plastic kit contains the following 5½" long needle files with round shanks and high test cutting qualities: round, half-round, flat, oval, knife, square. **98c** complete set postpaid

4 Pc. DROP-FORGED TANG CHISEL SET



Swedish pattern, of high quality tempered and hardened tool steel. Blades beveled and polished. Hardwood, leather tipped handles. Set contains one each ¼", ½", ¾" and 1" chisel in plastic compartment kit.

Complete Set — **$2.95** postpaid

POLISHED STEEL VERNIER CALIPERS

Imported precision instrument of 5" measuring capacity with inside and outside jaws, depth gauge and friction roller adjustment. Graduations 1/16" and 1/32", vernier readings 128".

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12" WORK BENCH LEVEL

Made of hardwood beech, kiln dried and lacquered. Equipped with horizontal and plumb vial. Horizontal vial covered with a steel plate NPL.

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29 Pc. TURNED-DOWN SHANK SPEED DRILL SET

Especially Made for Speed Drilling

Finest alloy steel drills, hardened and precision ground to the sharpest, longest-lasting cutting edge obtainable; will easily and cleanly bite through hardwoods, plastics, aluminum, iron, and the toughest steels. Unconditionally guaranteed for thousands of drillings. Full jobber-length, turned-down in the larger diameters so that all sizes fit into 1/4" electric drills. Sized by 64ths from 1/16" to 1/2", packed in a sturdy plastic tool roll with individual pockets.

$8.95

13 Pc. HIGH SPEED DRILL SET

Made of finest hardened tool steel. Especially designed for High Speed electric drilling through the hardest metal, steel and wood. Full jobbers lengths and are packed in a sturdy metal index. Sizes by 64ths. from 1/16" to 1/4". Made to sell for $3.98 our price only **$2.98.**

6 Pc. POWER AUGER BIT SET

Made of finest tool steel specially tempered and hardened to give years of quick, clean, easy drilling. Shanks will fit all electric drills. Packed in sturdy, heat-treated, compartmented plastic tool roll. Sizes: ⅜", ½", ⅝", ¾", ⅞", and 1".

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DRILL STAND

Rustproof, cadmium plated, will hold 21 Jobber or Letter Drills. Stands upright on shelf or bench. Drill sizes plainly marked on each opening. Sized by 64ths from 1/16" to 3/8".

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$1 MINIMUM ORDER, SEND CHECK OR MONEY ORDER. IF C.O.D., YOU PAY POSTAGE AND C.O.D. CHARGES. MONEY BACK GUARANTEE IF NOT COMPLETELY SATISFIED.

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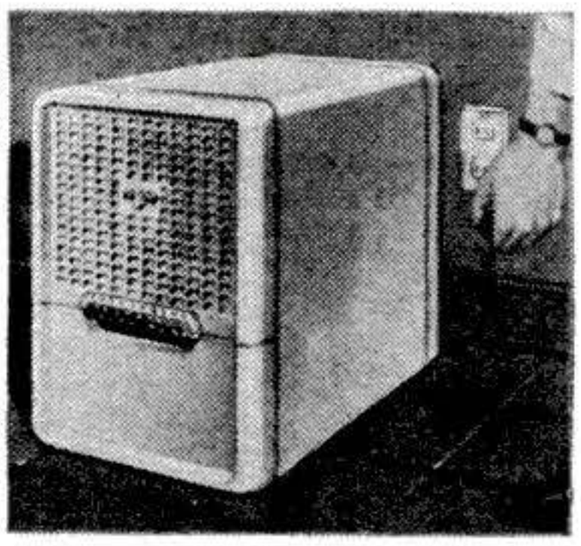
Just plug in the amazing FRIGIDAIRE Electric DEHUMIDIFIER



Only 18¼" high—20½" long—11¾" wide

Positively controls moisture in basements, linen closets, playrooms, workshops—or any closed area up to 10,000 cu. ft., where moisture is a problem.

Plug into any convenient outlet. Fan draws moist air through refrigerated coil. Moisture is condensed and collected in container. Dry, filtered air flows into room.

See your Frigidaire Dealer for further details. Or write for free folder to Frigidaire, Dept. 2251, Dayton 1, Ohio. In Canada, Toronto 13, Ontario.

Built and backed by General Motors

It's easy to "weave" a carport with MASONITE PRESDWOOD

It's different! Attractive! And easy to make! Use tough, grainless Masonite Tempered Presdwood®. Resists heat and cold, wind and water. Lasts indefinitely. Plan can also be used for a woven fence. See your building materials dealer. Send for "Idea Book" and carport plan No. AE-296.

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Please send me plan No. AE-296 for carport and your "Idea Book." I am enclosing 10c for handling and postage.

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JUST SPONGE IT ON - RINSE IT OFF!

FAST-ACTING, ECONOMICAL DU PONT CAR WASH

NEW DU PONT CAR WASH cleans faster and easier than you ever thought possible. Just sponge it on . . . rinse it off . . . and your car *dries itself*. No wiping or chamois work! Du Pont Car Wash gets off *all* the grease and grime . . . leaves your car spotless.

One tablespoonful washes your car. Half-pound can gives 20 washes!

DU PONT № 7® PRODUCTS

From Chemical Research . . . For Easier Car Care

DU PONT

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

America's Best Young Driver

[*Continued from page 83*]

As an added hazard, national Road-e-o cars—in both the skill test and the road check—carry little black boxes known as jerk recorders. Sudden starts and stops set pendulums to swinging and a counting device to clicking. Road-e-o judges know that in order to drive smoothly, you have to anticipate turns, stops and lane changes.

The Road-e-o's written quizzes become progressively harder, but even at the local level they demand more information than many an adult driver has bothered to acquire. Last year's national champ got 59 out of the 60 questions.

Each national finalist also gets a workout on an auto-training device. Sitting at the controls of an ordinary car, he guides a tiny model auto on a moving belt painted to look like a highway. As the road rushes by, it confronts him with a variety of problems. At the same time, a little sign box flashes instructions, and a miniature traffic light keeps changing. The driver's mistakes and reaction times are automatically recorded.

His Driving Took Him to College

Martin Desilets, the first national champion, entered the Road-e-o because he needed the prize money to study engineering. His first-place money got him to the University of Virginia for a year and a half; then he decided to quit school temporarily and get his military service over with. Now he's in the Air Force.

The runner-up that year, Milton Vaverek of Pontiac, Mich., had quite another problem, a foot crippled in infancy by polio. He flew home from the national Road-e-o on a Sunday morning and entered a hospital that afternoon for an operation. His money went for the bills.

Last year's winner, Jim Miholick, interested both in automotive engineering and music, planned to enter the University of Hawaii. Martin Burley of Fargo, N.D., runner-up, is studying architecture at North Dakota State. Frederick Betz of Baltimore, third-place winner, entered

[*Continued on page 238*]

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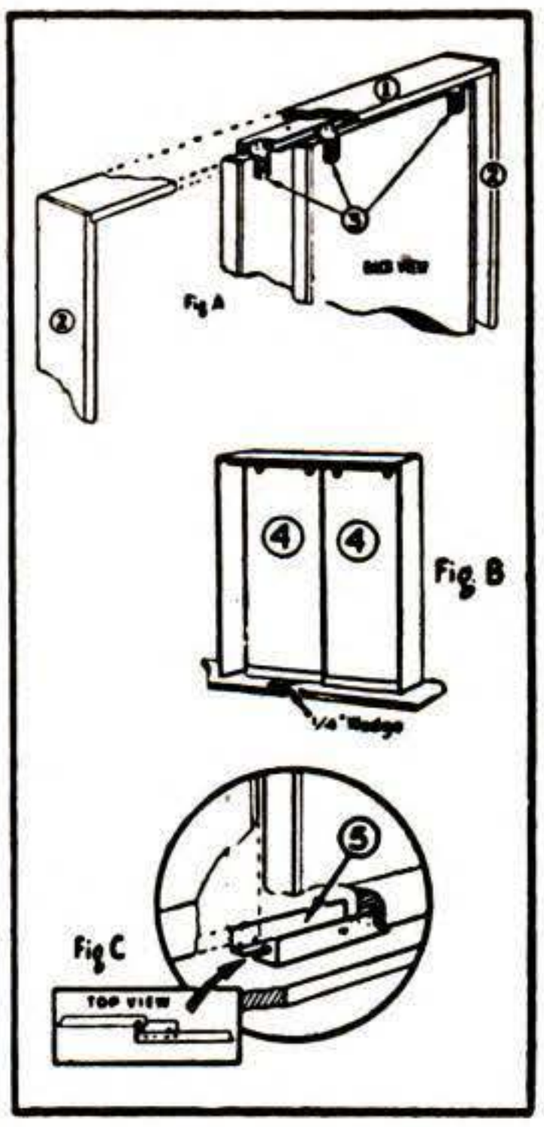

ADD A CLOSET IN A HURRY

with a NOVOPLY Sliding Door Unit

Family cramped for closet space? Make a closet and face it off with a Novoply Sliding Door Unit. It includes everything you'll need in one complete package — jambs, header with track, roller track hangers, doors with pulls and floor guides.

HERE'S ALL YOU DO:

1. Assemble header (1) and jambs (2) and place in rough opening. Shim jambs to make frame square.
2. Place adjustable overhead roller carriers (3) in grooves of overhead track in header (1).
3. Adjust doors with wedge (Fig. B) and secure with screw in carrier.
4. Install door guide clip (5) in floor (Fig. C).

You can have units ranging in height from 6′ 9½″ to 8′; in width from 2′ to 8′. Several together make a modern storage wall. Doors can be stained or left natural. Units available with or without upper storage area; in Novoply or genuine birch.

See your lumber dealer or send today for free folder.

- Easy to install and maintain
- Save up to 35% in floor space
- Cost less than ordinary doors
- Slide silently without binding
- *Guaranteed* against warping in excess of ⅛″ when properly installed and finished.

Novoply Sliding Door Units by

Weldwood®

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World's Largest Plywood Organization
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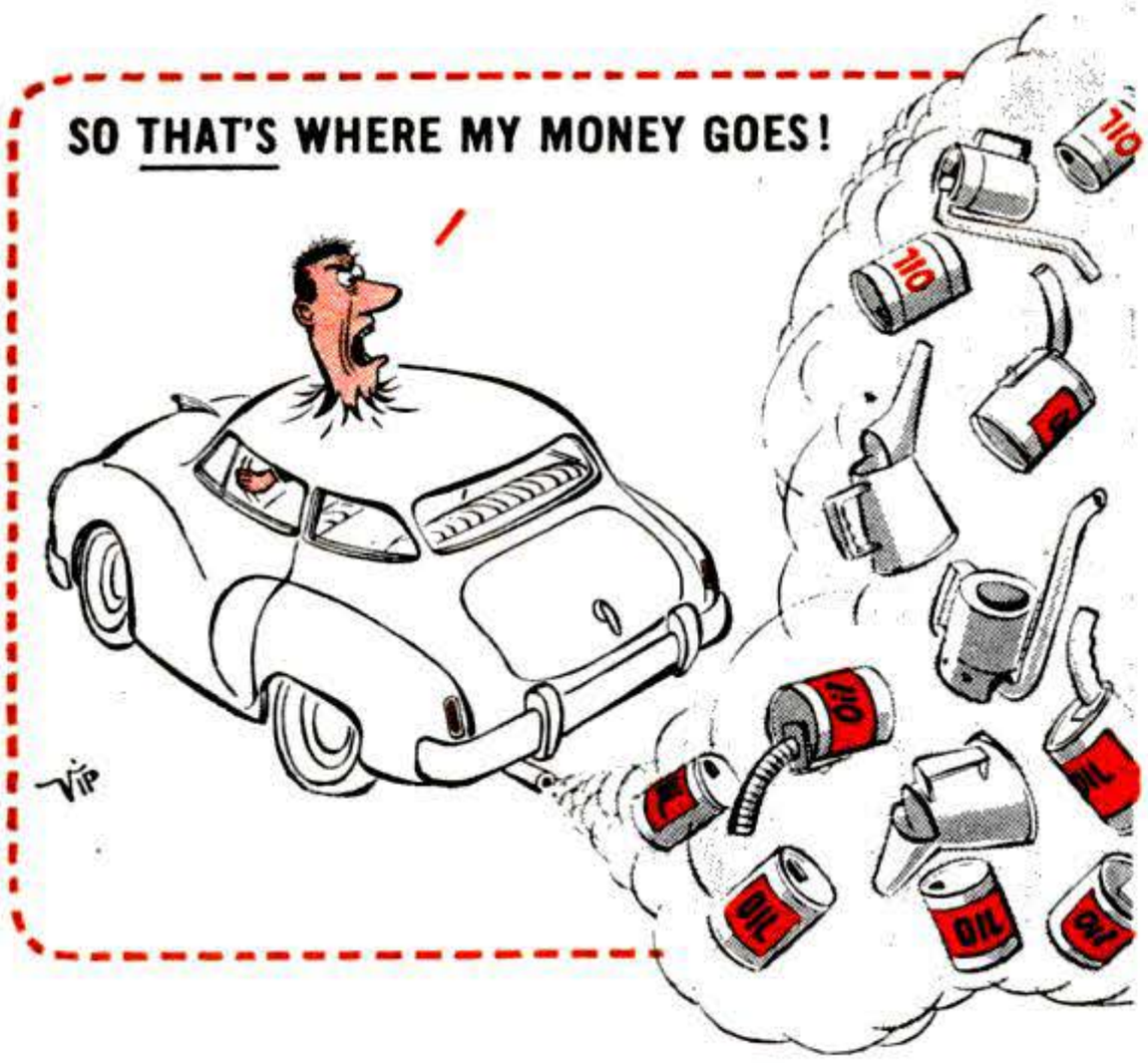

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As your engine gets older, it runs hotter because of accumulations in the cooling system. The cylinders wear tapered and out-of-round—need more oil on the walls.

It requires a special type of piston rings—*replacement* rings—to deliver this extra oil, under full control, without waste.

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That's why Hastings Rings *stop* oil-pumping, *check* cylinder wear, *restore* engine performance—in re-ring, re-bore and re-sleeve installations.

So go to your motor specialist at the first sign of oil-pumping or performance drop-off. If rings are the trouble, ask him to install a Hastings Steel-Vent replacement set. Truly the best money you can spend on your car!

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HASTINGS
STEEL-VENT PISTON RINGS

America's Best Young Driver

[Continued from page 236]

Johns Hopkins to study civil engineering.

Most of the top teen-age drivers practiced hard for the Road-e-o, after getting an idea from the local contest about what to expect. Desilets laid out an obstacle course in a nearby park; Vaverek, on the family farm, where he'd begun driving at 10; Betz, on a dead-end street. Mell Carey of Berkeley, Calif., a national finalist for two years straight, practiced weekends on a school playground.

Kids Want Earlier Training

After last year's finals, the entrants got together to discuss good driving. Carey argued that since driving is an art, it ought to be started as early as possible. He suggested that use-at-your-own-risk areas be set aside for beginners, but that licenses should be granted only after a difficult test.

Most of the others agreed that behind-the-wheel training ought to be started earlier than it often is—say at 14. Driver education is compulsory for St. Louis, Mo., high-school seniors, Jerry Kassing pointed out, but by that time "most of the kids have been driving for two years and they already have bad habits."

Several criticized school officials who balk at thoroughgoing driver-education programs because of expense. C. A. Tovey of Jacksonville, who represented Florida twice in a row, put it this way: "My instructor said it costs $3,800 to put a youngster through high school. But what's the point if a kid gets killed in an accident on graduation day?" END

It's a Long Road

An irate chief engineer was inspecting a stretch of newly built road, accompanied by the foreman in charge of the gang.

He pointed out to the bewildered foreman that the shoulder beds were off, that the curves were banked wrong, that the foundation was not right, that the leveling was far from perfect.

Finally, after the avalanche of criticism, the old foreman spat on the ground, gave his superior a bland look, and asked: "Well, how is it for length?"—*Pure Oil News.*

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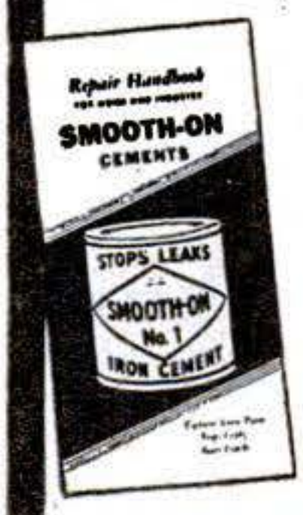

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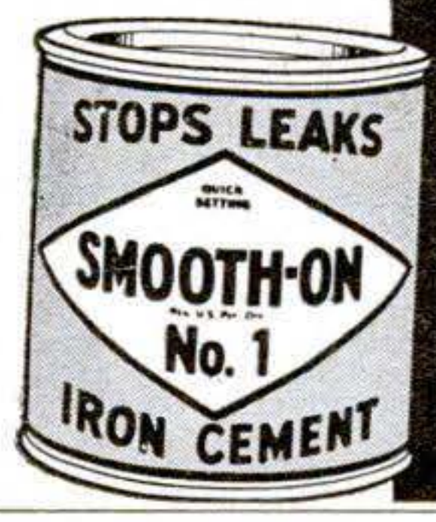

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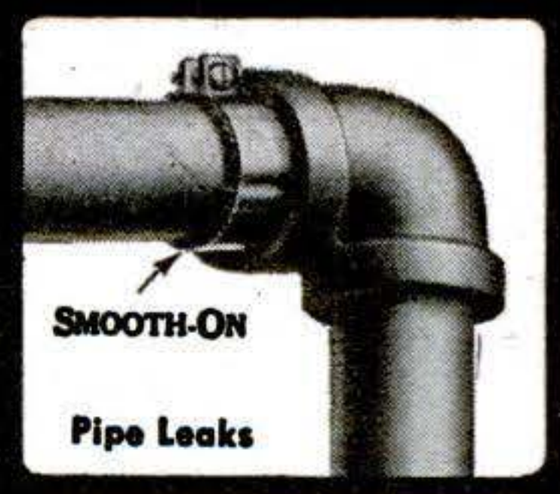
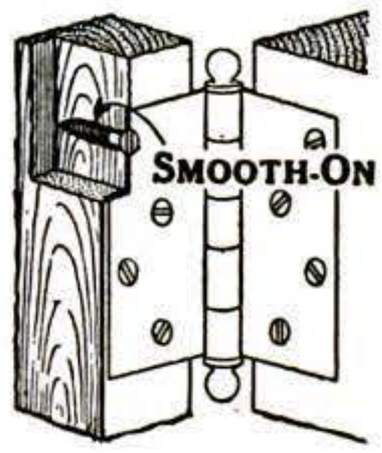


Pipe Leaks



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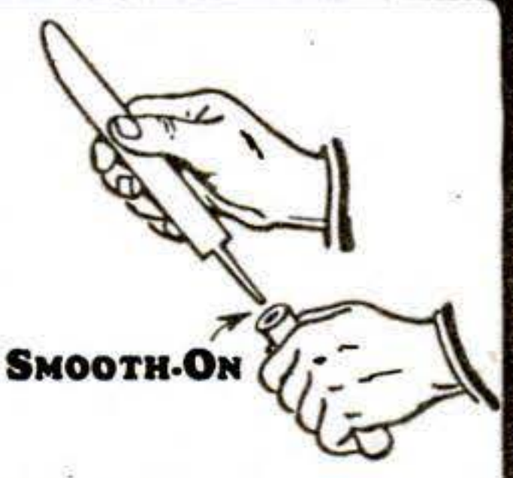

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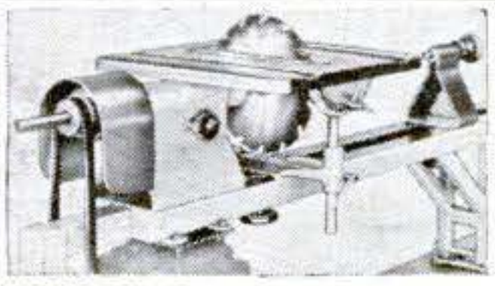

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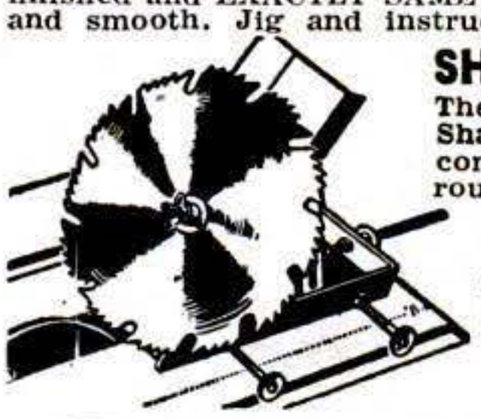

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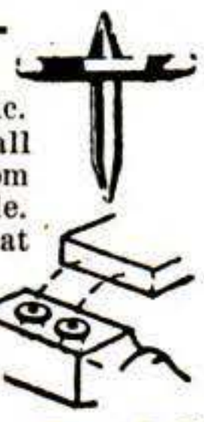

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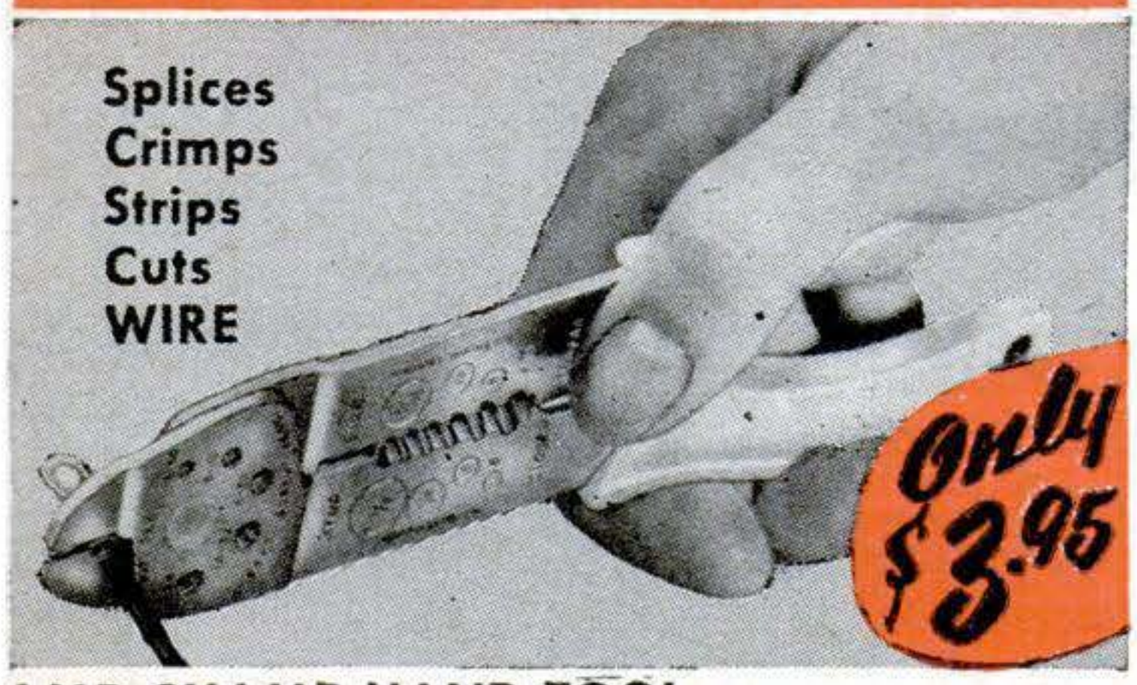

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Finding Fortunes in Uranium

[Continued from page 96]

shaft-sinking and drilling by his Utex Exploration Company shows the ore body so extensive that it may contain as much as $100,000,000 worth of ore. Others have since struck it rich near his claims, too, and the booming new uranium region may eventually rival or surpass the Colorado Plateau's carnotite district.

Government Offers Aids

The Government doesn't mine uranium itself—it encourages private enterprise to do the job, and does all it can to help, through the AEC, the Geological Survey and the Bureau of Mines. Its experts have walked thousands of miles of canyon rims, examined more than 5,000 mines and prospecting diggings, flown airborne ore-detecting instruments more than 60,000 miles, and examined more than 40,000 samples of rock submitted by the public and their own staff. Bulletins and reports make public their findings. And prospectors may examine maps, newly posted in AEC offices on the fifteenth of each month, showing them likely places to look for uranium.

Planes carrying radioactivity-detecting instruments have flown over the mapped areas, and marks on the maps show wherever unusual radioactivity indicates possible uranium deposits. The AEC now flies six Super Cub planes equipped for this new technique of airborne prospecting, and private companies are following suit. In the new South Dakota carnotite region, three-fourths of the mines were discovered from the air.

Geological Survey parties, on their way by road to investigate reported deposits of uranium, sometimes find it nearer at hand. To miss no bets, they ride in a truck with a king-size Geiger counter on its roof. Thus uranium has been found in places where geologists would never have thought of looking for it.

How can you find uranium yourself? If you're interested seriously enough to want all the practical details, your meat is a best seller among Government publi-

[Continued on page 242]

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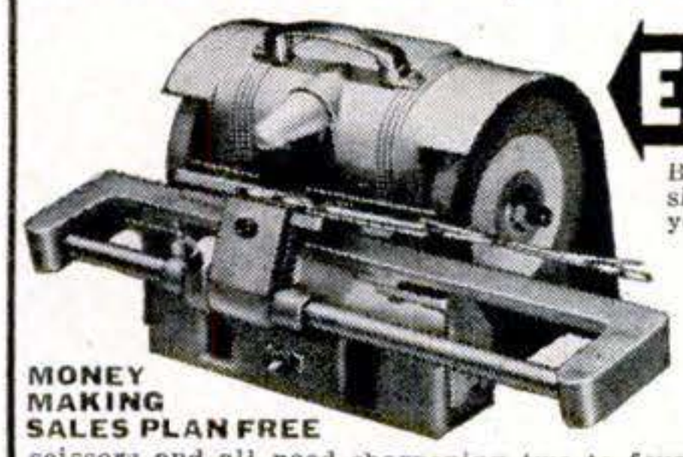

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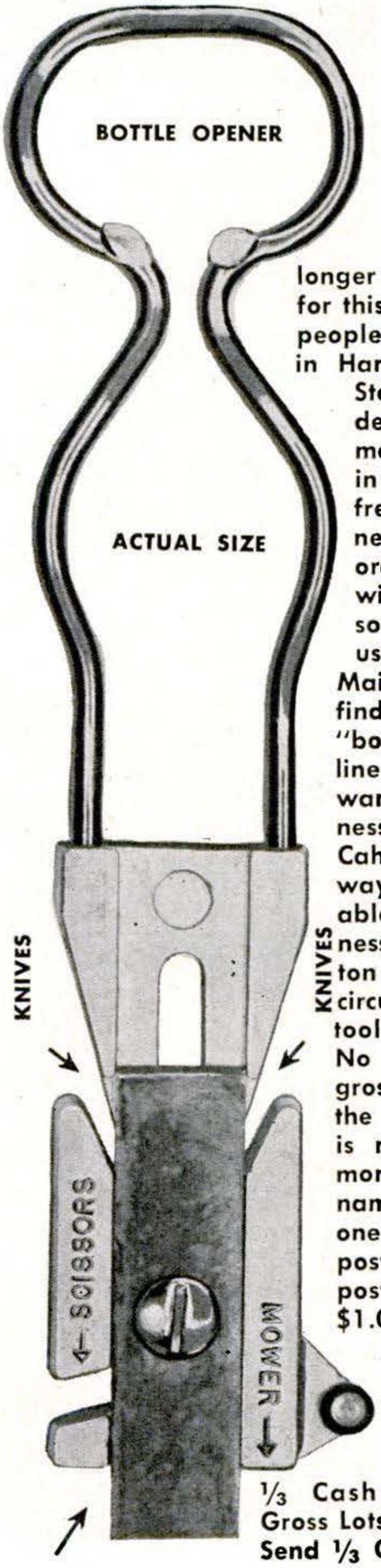

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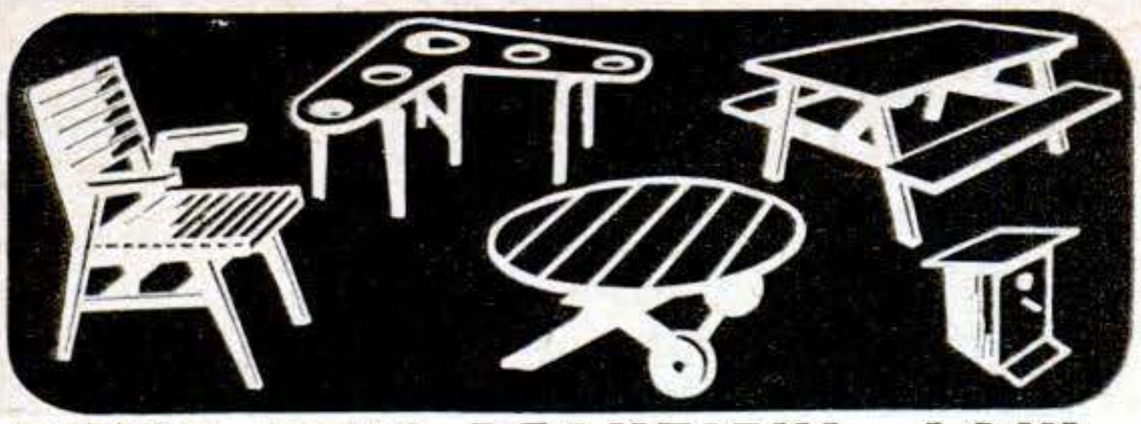

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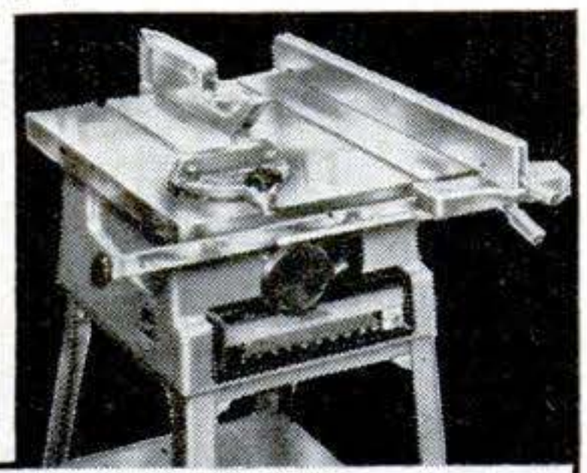

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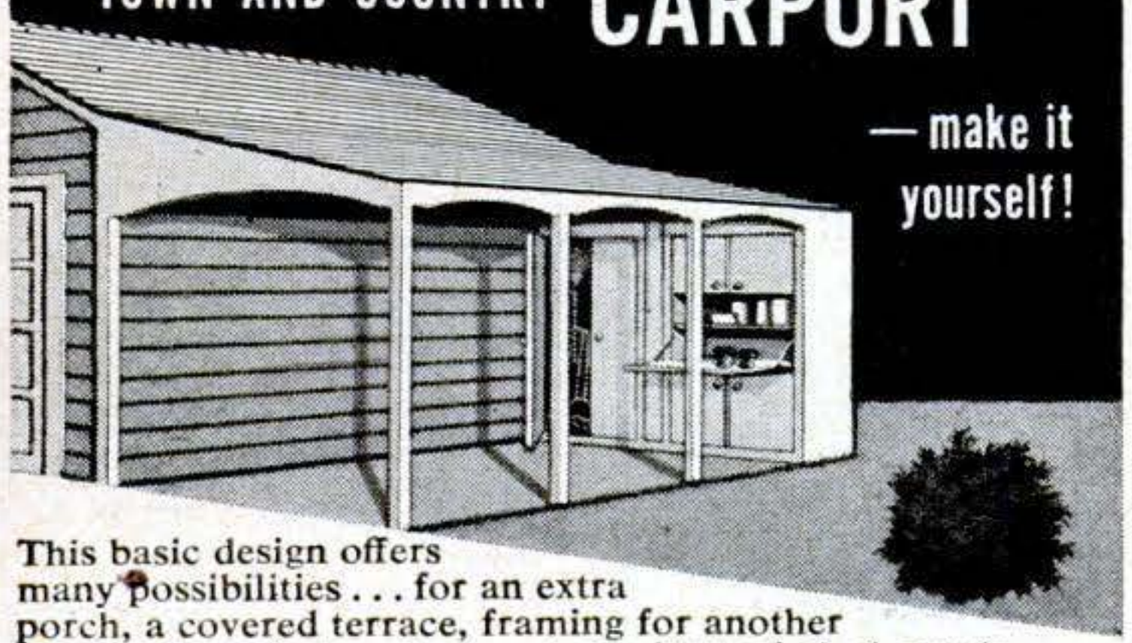

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Finding Fortunes in Uranium

[Continued from page 240]

cations, the official pocket manual entitled *Prospecting for Uranium.* It may be obtained for 55 cents from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., and its 123 pages of text are crammed with helpful information.

Pointers for Uranium Seekers

But here are just a few tips from experts that may help some reader to discover a new uranium deposit:

Know what uranium minerals look like. You can see them in museums, buy them from dealers in mineral specimens, or study eight color photographs of them in the Government manual.

Look in likely places. Carnotite deposits often are found along former beds of ancient streams. And they turn up in petrified logs and branches, whose carbonaceous material seems to have favored deposition of uranium.

Watch for guiding clues. Where dark-purple or black fluorite is found, the vicinity should be checked for radioactivity; sometimes dark-colored fluorite and uranium occur together, although there are many exceptions. Scattered flakes of green and yellow secondary uranium minerals, such as torbernite and autunite, may be surface signs of an underlying pitchblende vein.

Nevertheless, the most favorable site, by signs such as these, may prove utterly barren of uranium. And where there shouldn't be any uranium, by all the "rules," a bonanza may be discovered. That's the gamble and excitement of it—uranium is where you find it. END

What a Question

The steel worker, lunch pail in hand, was hobbling noticeably when the foreman asked the trouble.

"Got a nail in my shoe."

"Why don't you take it out?" asked the foreman.

"What! . . . On my lunch hour?"—*The Wyatt Way.*

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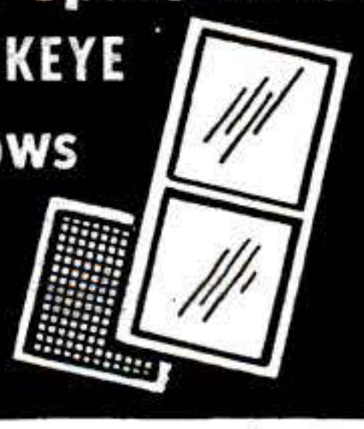

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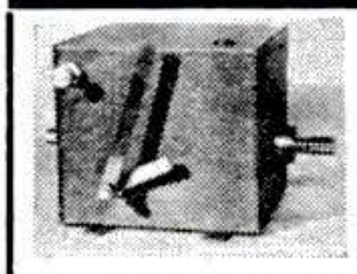

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International Racing Champion

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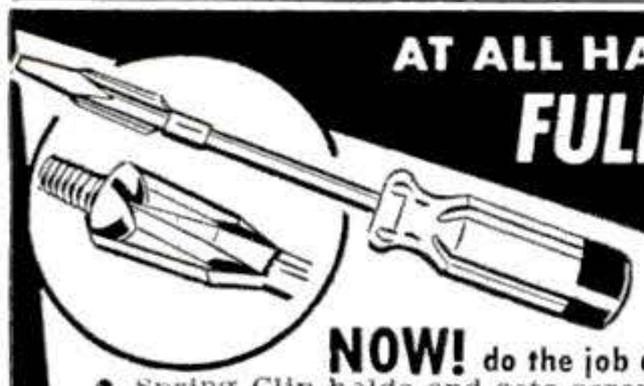

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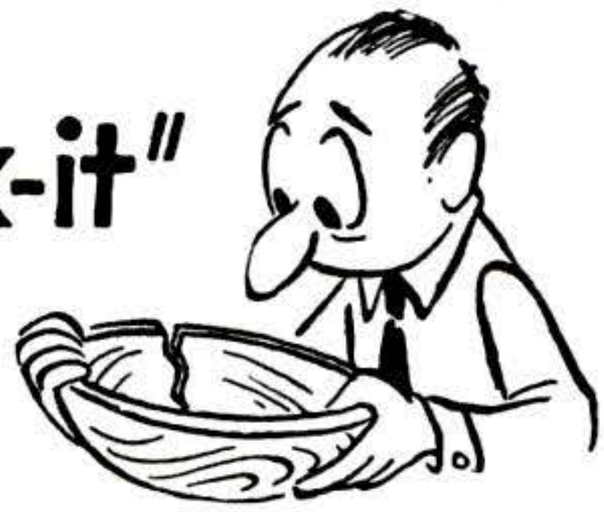

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Let's Put Some Science in SF

[Continued from page 137]

quire refueling only a few times a year. Could not thrilling stories be told about the railroads of the future?

The sea has an endless fascination for men. Moby Dick came out of its depths. Could a new age of whaling arise from warm water set flowing by submerged islands of nuclear power?

Robot Criminals and a Robot Court?

Electronic brains can talk to each other by telephone; some of them have been put to work sifting clues to detect criminals; a few have been assigned to deal with traffic-law violators. Since automobiles that drive themselves are in experimental operation already, can we expect to have justice tempered with mercy in a robot traffic court presiding over robot drivers?

The answer to the last question is clear: no, we cannot have either justice or mercy unless science-fiction writers start now to prepare the human minds that eventually will instruct robots.

The peak of true artistry is reached when the master craftsman—sculptor, painter, musician or writer—so faithfully transmits the currents of life about him that his work reveals the future taking shape.

There can be no doubt whatever that the future of democracy depends on science. Nuclear and electronic discoveries are whirling us through space and time at ever faster speeds. Only those brains that keep pace can possibly control the good or evil that the unending spawn of machines will do. And thousands of brains are disqualifying themselves because the human spirits to which they belong have come to loathe and fear science.

Number of Science Teachers Dwindles

The crisis is not approaching. It is upon us. According to the National Manpower Council, the United States will not have enough scientists to keep up with science for at least 10 years. Fewer

[Continued on page 246]

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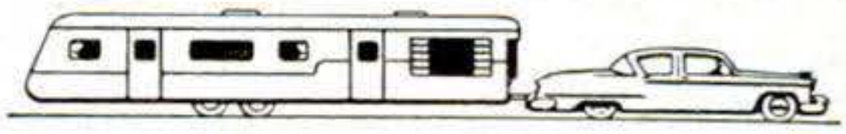

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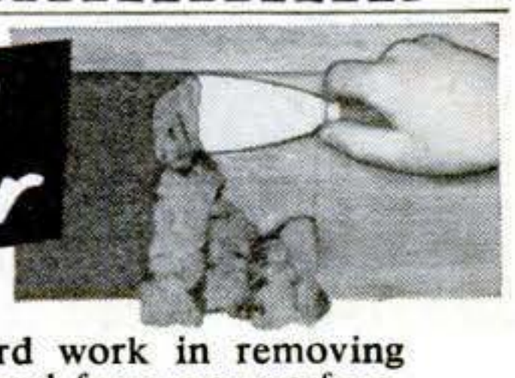

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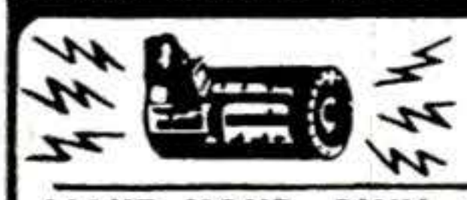

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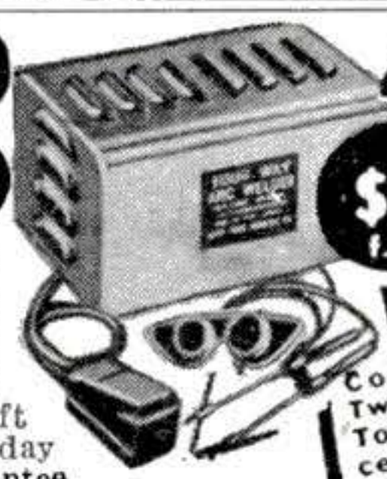

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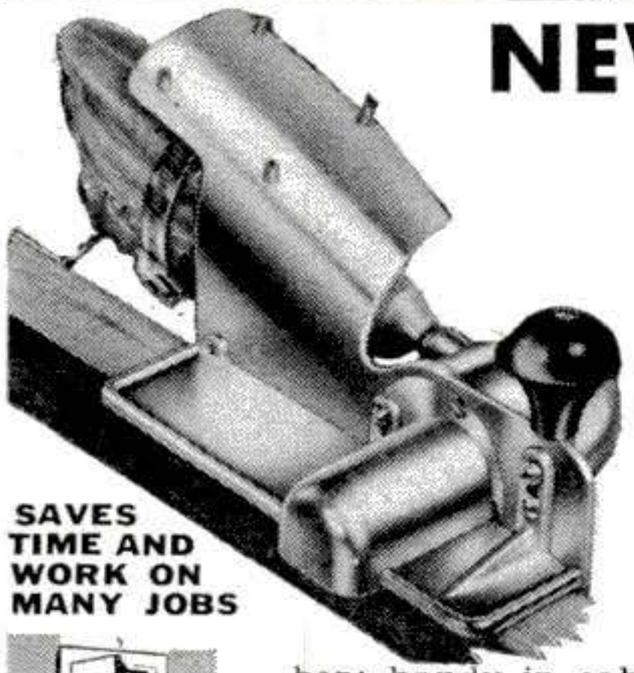

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Let's Put Some Science in SF

[*Continued from page 244*]

young people are preparing to teach science than any other subject in the public-school curriculum. The annual crop of potential science-teaching aspirants is dwindling toward half the potential need. In the country's high schools, the significance of science has been perversely minimized by requiring one of every two science teachers to teach other subjects on the side.

What a boon it would be to these overworked professors—and to American ideals, not to mention our common safety—if the scientific background of science-fiction were authentic enough to allow SF short stories and novels to be assigned as out-of-class reading!

Obviously, this could be a primary way to stimulate American youth to appreciate the logical spirit of scientific inquiry, to think imaginatively within a stated discipline, to carry on the warfare that science from its beginning has waged against human ignorance and misery.

Science-fiction cannot play this vital role in our civilization as long as its writers merely label cowboy, detective and sex stories "scientific"—nor as long as their philosophy persists in dooming mankind by means of disintegrator buttons pushed by robots hot-rodding through space on comets.

I am willing to predict that the next great science-fiction classic will substitute hope for horror, faith for despair, and tell its story in the simple everyday words of the ordinary man who today fears science because he thinks "it's too far over my head."

Man Is Responsible for His Destiny

Above all, this next great SF classic will make unmistakably plain the established scientific fact that man is responsible for his acts.

The author of this future classic will not allow himself to forget that he is writing primarily about people. But neither will he accept the gibberish Wil-

[*Continued on page 248*]

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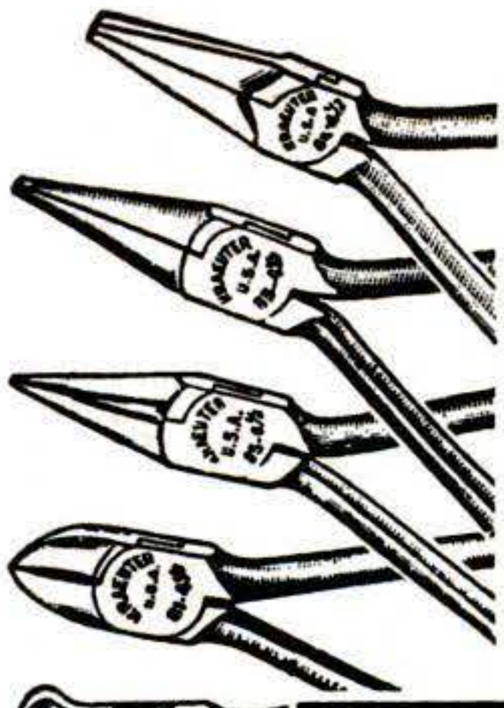

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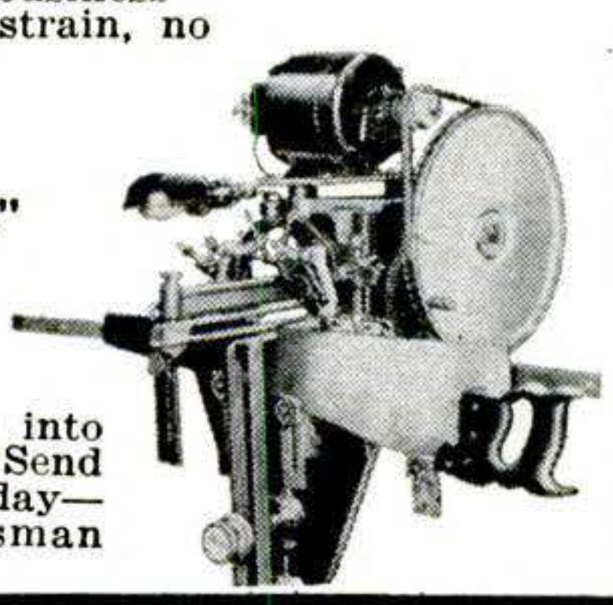

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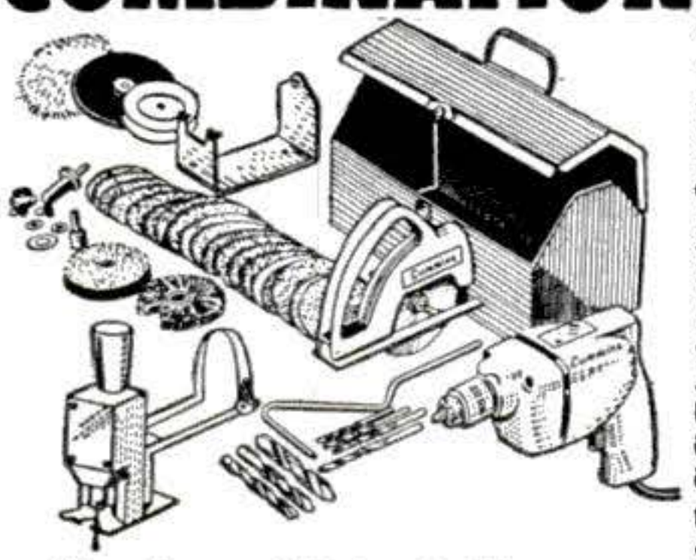

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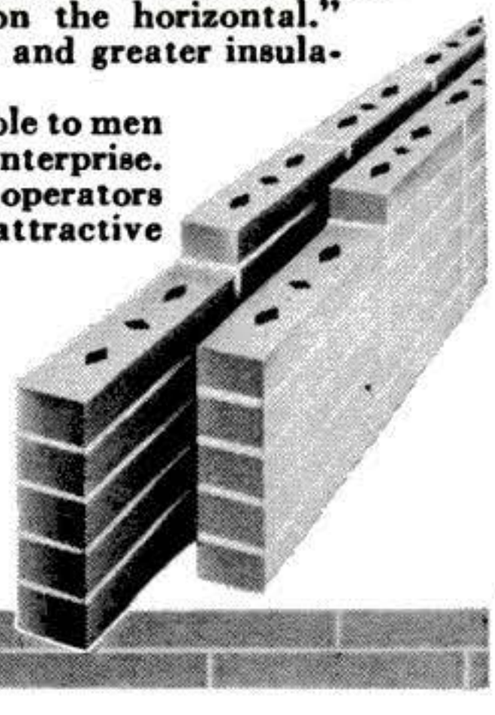

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Let's Put Some Science in SF

[Continued from page 246]

liam Tenn expounded as logic in a recent issue of *Science-Fiction Adventures:*

> Whether the people are modern homo sapiens hammering out the first rocket, twenty-fifth century mutants hammering out the first ssl-yyrdk, robots trying to form labor unions, androids fighting to have the manufacturer's label removed from their backsides, or monocotyledonous Arcturians pathetically attempting to smuggle themselves past Terran Immigration disguised as lima beans, it is first and foremost with their problems and view of *themselves* as people that the SF writer has to deal successfully.

Robots aren't and never will be human. So it's manifestly impossible for a human writer ever to think and feel like a robot. To make an issue of this distinction might be absurd at another time. But it is not absurd now. For, if any one superstition has, more than any other, caused people to reject and fear science, it is the belief that machines can be taught to think and thus to take over the management of human affairs.

Robots Can Only Follow Orders

Robots cannot think, nor will their progeny be able to think. They will be able to direct complicated tasks at high speed, and to correct mistakes they may make in the process. But their performance of the tasks will be only as efficient as human minds plan it, step by step, in advance; and the errors they correct will be only those errors that human minds foresee and calculate alternate actions for—in advance. Man's destiny will remain in man's own hands.

Science-fiction can mirror this truth of human life only by living up to its name: by applying disciplined creative imagination to the known discoveries and logical principles of science. END

Dad's Contribution

The children may have their mother's eyes, intelligence and her curly hair—but they usually wind up with their father's car keys.—*Wall Street Journal.*

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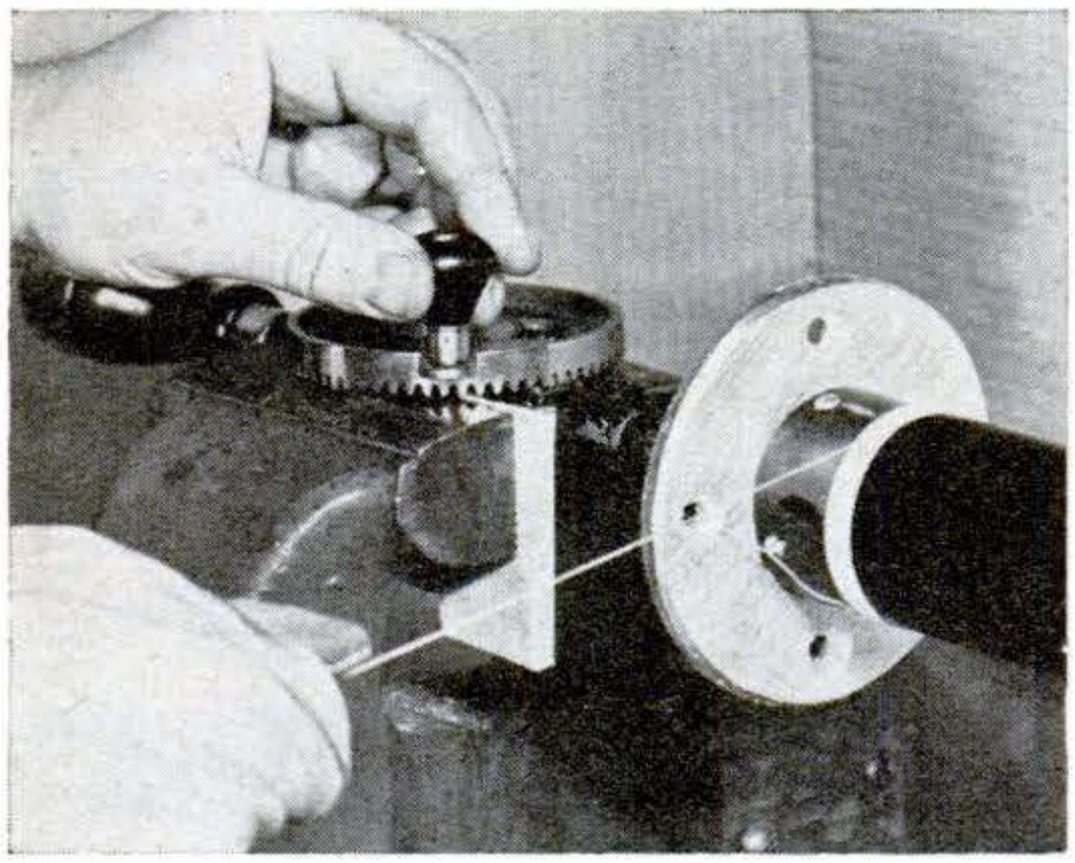
How Much Did You Learn?

By Stanford E. Taylor and Helen Frackenpohl
Washington Square Reading Center, New York

Now you can sample how much you remember of the useful and interesting information packed into this issue of POPULAR SCIENCE MONTHLY. Answers to the questions are printed just below the quiz. After each answer is a page reference to the article on which the question was based.

1. *Taking good action pictures of boats depends in large part on*
a. anticipating their maneuvers
b. correct shutter speed
c. keeping the wind to your back

2. *This is a good way to*



a. unsnarl fishing line
b. wind a Tesla coil
c. repair a telescope

3. *West Virginia's 87 miles of new hill-hopping superhighway have*
a. 76 bridges
b. 14 tunnels
c. no toll gates

4. *Hydrojet is a form of propulsion used in*
a. seaplanes
b. model boats
c. amphibious troop carriers

5. *This year's Teen-Age Road-e-o to pick a national champion driver has attracted*
a. 30,000 entrants
b. 140,000 entrants
c. 250,000 entrants

6. *The fabulous new aircraft carrier* Forrestal, *to be launched this fall, has a length of*
a. 893 feet
b. 1,039 feet
c. 1,203 feet

7. *The hopper 'dozer was used to*
a. move grain
b. collect grasshoppers
c. level jungle airstrips

8. *MOUSE, an artificial satellite, is designed to be fired into the upper atmosphere to*
a. serve as an interplanetary observatory
b. direct guided missiles
c. study solar and cosmic radiation

9. *If traveling down a long mountain grade causes your brakes to fade, you know that*
a. temperature is to blame
b. your brake fluid is low
c. the linings are worn

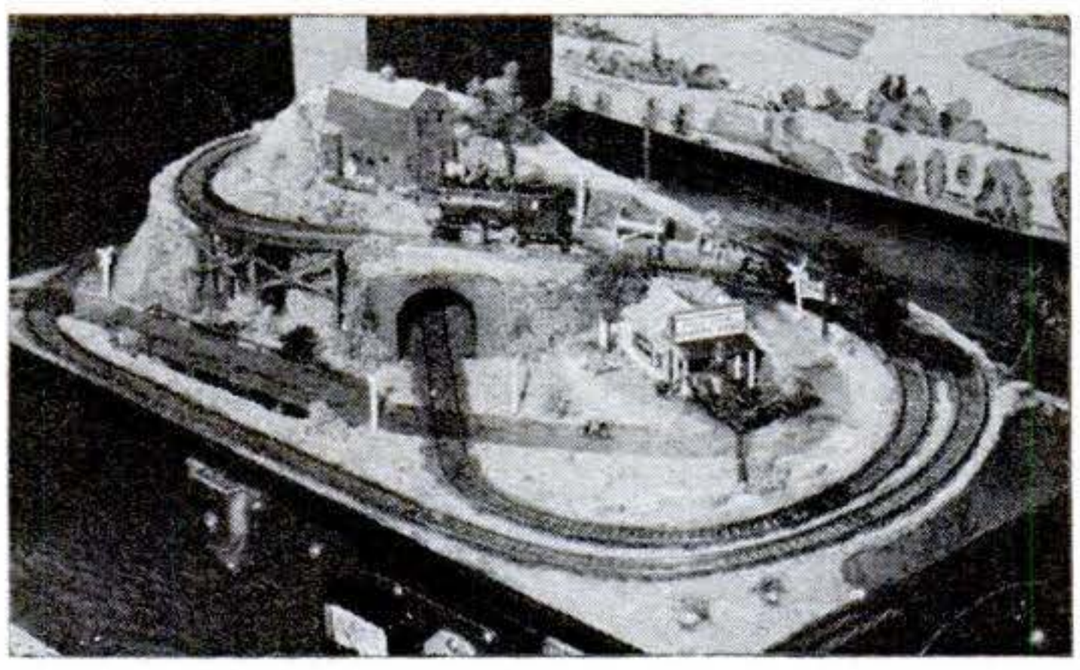
10. *The Atomic Energy Commission's part in the national hunt for uranium is to*
a. take over the mining operation
b. buy up all the ore mined
c. arrange for loans on mining equipment

Answers: 1. a—p. 166; 2. b—p. 190; 3. a—p. 65; 4. b—p. 170; 5. c—p. 80; 6. b—p. 128; 7. b—p. 116; 8. c—p. 72; 9. a—p. 100; 10. b—p. 92.

NEXT MONTH . . .

The New Boom in Table-Top Trains

Lack of space need no longer keep you from the fun of scale-model railroading. With tiny TT gauge, an elaborate layout fits on a table top—or into a suitcase. The September issue of PSM will tell how to get started and show interesting setups built by experts in this booming hobby.



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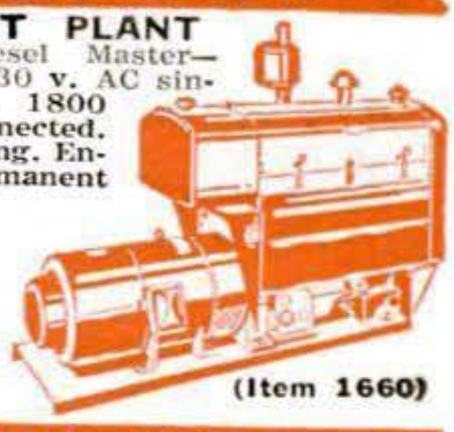

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Blade	Opening	Rooms	Wt.	Item	Price
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30"	34 x 34	7	90 lb.	555a	$74.50
36"	40 x 40	9	105 lb.	555b	$82.50
42"	46 x 46	11	150 lb.	555c	$93.50

Add $6.00 to above prices for horizontal mounting.

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Blade	Opening	CFM	Wt.	Item	
16"	18¼"	2925	19 lb.	365a	$27.95
18"	19¼"	3600	27 lb.	365b	$31.95
20"	21¼"	4100	30 lb.	365c	$39.95

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How I foxed the Navy

by Arthur Godfrey

The Navy almost scuttled me. I shudder to think of it. My crazy career could have ended right there.

To be scuttled by the Navy you've either got to do something wrong or neglect to do something right. They've got you both ways. For my part, I neglected to finish high school.

Ordinarily, a man can get along without a high school diploma. Plenty of men have. But not in the Navy. At least not in the U. S. Navy Materiel School at Bellevue, D. C., back in 1929. In those days a bluejacket had to have a mind like Einstein's. And I didn't.

"Godfrey," said the lieutenant a few days after I'd checked in, "either you learn mathematics and learn it *fast* or out you go. I'll give you six weeks." This, I figured, was it. For a guy who had to take off his shoes to count above ten, it was an impossible assignment.

I was ready to turn in my bell-bottoms. But an ad in a magazine stopped me. Here, it said, is your chance to get special training in almost any subject—mathematics included. I hopped on it. Within a week I was enrolled with the International Correspondence Schools studying algebra, geometry and trig for all I was worth.

Came week-end liberty, I studied. Came a holiday, I studied. Came the end of the six weeks, I was top man in the class. Within six weeks I had mastered two years of high school math, thanks to the training I'd gotten.

I.C.S. made the impossible—easy!

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- ☐ Quality Control
- ☐ Reading Shop Blueprints
- ☐ Refrigeration
- ☐ Sheet Metal Worker
- ☐ Tool Design ☐ Toolmaking

RADIO, TELEVISION
- ☐ Electronics
- ☐ Practical Radio—TV Eng'r'ng
- ☐ Radio and TV Servicing
- ☐ Radio Operating
- ☐ Television—Technician

RAILROAD
- ☐ Air Brakes ☐ Car Inspector
- ☐ Diesel Locomotive
- ☐ Locomotive Engineer
- ☐ Section Foreman

STEAM AND DIESEL POWER
- ☐ Combustion Engineering
- ☐ Diesel—Elec. ☐ Diesel Eng's
- ☐ Electric Light and Power
- ☐ Stationary Fireman
- ☐ Stationary Steam Engineering

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- ☐ Carding and Spinning
- ☐ Cotton, Rayon, Woolen Mfg.
- ☐ Finishing and Dyeing
- ☐ Loom Fixing
- ☐ Textile Designing
- ☐ Textile Eng'r'g ☐ Throwing
- ☐ Warping and Weaving

MISCELLANEOUS
- ☐ Domestic Refrigeration
- ☐ Marine Engineering
- ☐ Ocean Navigation
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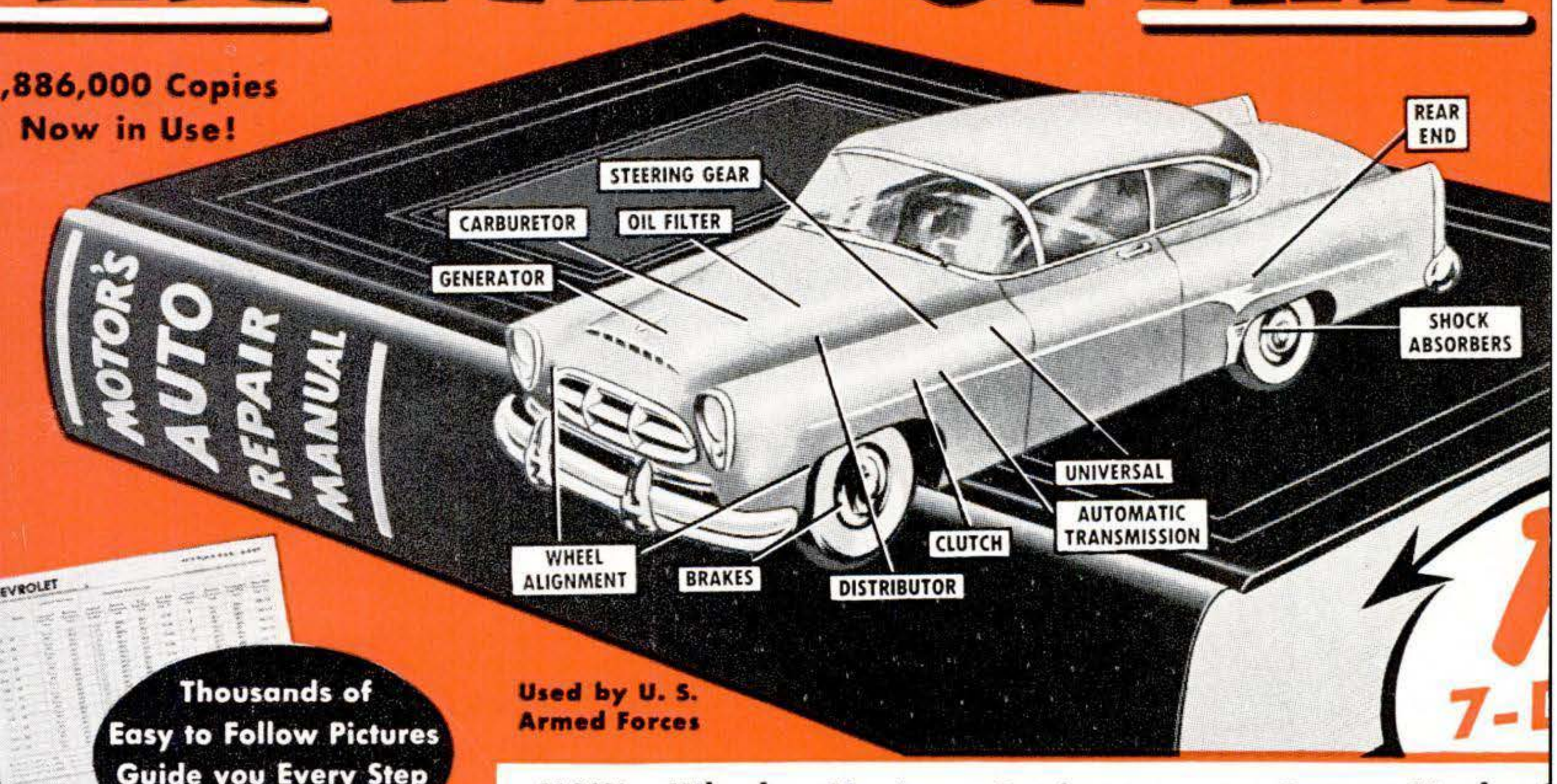

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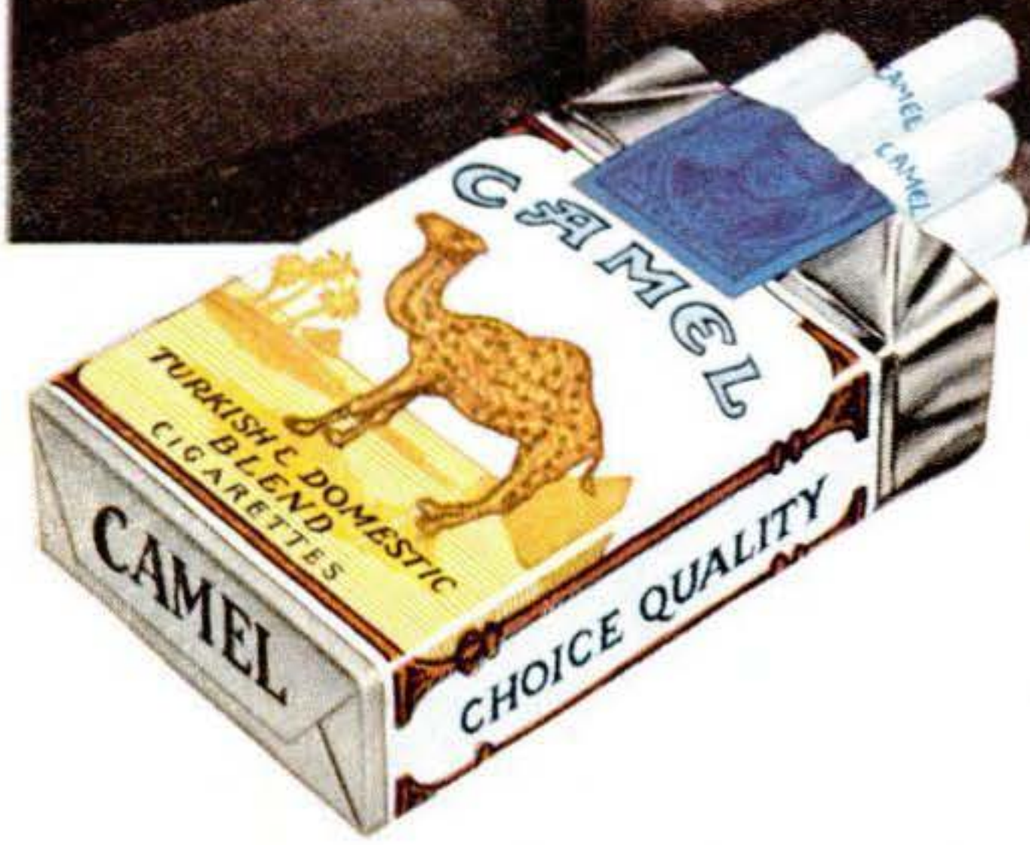

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